THE HOPE REPORTS

VOL. VI

1906—1908

EDITED BY

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THE MAKERS OF THE HOPE DEPARTMENT
OXFORD UNIVERSITY MUSEUM

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PREFACE

THE memoirs contained in the sixth volume of Hope Reports were published in the course of the two years extending from June, 1906, to June, 1908. In consequence of Mr. R. Shelford's labours and influence the present volume contains a far larger proportion of papers devoted to insect systematics than any of its five predecessors.

Memoirs 2–11 are chiefly or wholly concerned with bionomic subjects. Mr. T. R. Bell (8), Mr. A. H. Hamm (10), Mr. S. L. Hinde (9), Mr. W. J. Kaye (4), and Mr. S. A. Neave (2), have each contributed one of these, Dr. F. A. Dixey three (5–7), and the Hope Professor two (3) and (11). Mr. W. J. Kaye kindly consented to the inclusion of his important paper (4), dealing with questions which are greatly studied in the Hope Department. A part of the material figured in the plates belongs to the University Collections, while the whole of the five plates were arranged in Oxford, and the four uncoloured ones photographed for half-tone reproduction by Mr. Alfred Robinson. Mr. T. R. Bell's paper on Indian butterflies (8) was compiled from the author's correspondence with Professor Poulton.

The twelfth memoir by Dr. F. A. Dixey and Dr. G. B. Longstaff (12), and the succeeding three papers by Dr. C. B.

Longstaff (13–15) contain the record of observations—chiefly bionomic—on insects met with in various parts of the world.

The succeeding seven memoirs, by Mr. R. Shelford (16–22), contain important contributions to the systematics, and, in the case of no. 22, to the natural history of the *Blattidae.*

The memoir (23), by Dr. J. L. Hancock of Chicago, is a valuable account of a large part of the Oxford material belonging to an obscure and difficult group of *Acridiidae* ('grasshoppers').

The succeeding three papers, by Mr. R. Shelford (24), and Commander J. J. Walker (25 and 26), deal with Coleoptera. Commander Walker's list of beetles observed in the Oxford district from 1819 to 1907, will be of great value in stimulating and assisting the study of this group of insects.

A long series of brief communications published in the 'Proceedings of the Entomological Society of London' was a marked feature of the fifth volume of Hope Reports. Although far shorter than on the last occasion, when the volume covered a much longer period, the list of such communications in the book now issued is of considerable length. The subjects treated are chiefly bionomic, and it is unnecessary to do more than refer the reader to the descriptive titles printed under nos. 27–29 in the Contents.

A detailed account of the progress of the Hope Department during 1906 and 1907 will be found in the Hope Professor's Reports (30 and 31).

An important memoir by Mr. Guy A. K. Marshall has been kept back for Volume VII. In it the author advances many serious criticisms of the principle of Diaposematic Resemblance (Reciprocal Mimicry). His paper has only been made public, in the 'Transactions of the Entomological Society of London', within the last few weeks, and it will be more convenient to issue it in the next volume, which will no doubt contain reprints of further publications on the same subject.

Two interesting series of notes by Commander J. J. Walker on the Lepidoptera of the Dale Collection are also kept back, in the hope that they may be completed and issued as a whole in Volume VII.

EDWARD B. POULTON.

HOPE DEPARTMENT OF ZOOLOGY,
UNIVERSITY MUSEUM, OXFORD,
June 26, 1908.

CONTENTS OF VOL. VI

XII. *Some bionomic notes on Butterflies from the Victoria Nyanza.* By S. A. NEAVE, M.A., B.Sc., F.E.S., Magdalen College, Oxford.

[Read June 6th, 1906.]

PLATES IX—XII.

THE following notes on the bionomics of African butterflies mainly refer to the large collection recently sent to the Hope Department, Oxford University Museum, by Mr. C. A. Wiggins, M.R.C.S., F.E.S., etc., etc. This magnificent collection, with excellent data, has already been described in Nov. Zool. vol. xi, pp. 323–363, 1904.

A further large and important collection from the same region, made by Mr. A. H. Harrison, has also been made use of to some extent. Where numbers are given, they generally refer to Mr. Wiggins' collection only.

The district whence these specimens come proves itself to be of peculiar interest to students of geographical distribution. It is here that we have a great commingling of Eastern and Western forms. In the list of specimens in the paper above referred to will be found records of such species as *Elymnias phegea*, Fabr., *Bicyclus iccius*, Hew., many species of *Planema*, *Euxanthe crossleyi*, *Charaxes zingha*, Cram., to mention only a few, all of which until a few years ago were thought to be species confined to the tropical West Coast of Africa. These are mingled among many truly East African forms.

As will be seen later, *A. niavius* and *dominicanus*, originally described as distinct species and subsequently considered distinct forms, are now shown to form a syngamic group. This extension of the Western fauna to E. Central Africa is most probably due to the extension eastward of dense forest land, similar to that on or near the western tropical coast. The climate on or near the equator has apparently much less defined wet and dry seasons, resulting in a humid atmosphere and equable temperature more suitable to the growth of dense vegetation.

This absence of well-defined wet and dry seasons has a marked effect on the seasonal forms in the Lepidoptera of the country, well-marked seasonal characters being relatively scarce. In studying the mimetic groups in such a large

number of specimens there are to be found many points of interest. We can hardly fail to notice that nearly every species which exists in large numbers (and has therefore been successful in the struggle for existence) almost invariably forms the model for other species, or itself exhibits Müllerian mimicry with other abundant and distasteful species. In some cases it is true a few models, viz. certain species of *Planema*, were only taken in very small numbers, but when we see that their mimics (spp. of *Pseudacræa*) were also equally scarce, it is allowable to suppose that either owing to their retiring habits or some other such cause these species were overlooked, or that the collection was made near the edge only of their area of distribution.

Association of Amauris echeria jacksoni, Sharpe, *and A. albimaculata*, Butler, *with A. psyttalea* f. *damoclides*, Staud.

On examining a large series of both *Amauris echeria* and *A. albimaculata*, which, as Messrs. Rothschild and Jordan * have recently pointed out, are clearly distinct species, I was much struck with the difference between the Victoria Nyanza specimens and those from Southern Africa.

The *echeria* specimens have long since been described by Miss Sharpe as *A. jacksoni*,† a distinct species, but are doubtless not more than a geographical race of *A. echeria*.

The *albimaculata* specimens are extremely like, if not identical with *A. hanningtoni* of Butler,‡ which is also only a form of *albimaculata*. I shall endeavour to show that both these forms differ from typical South African ones in a common direction, and that these differences are due to the presence of *A. psyttalea*, bringing all three species into a clearly marked synaposematic group.

The Uganda specimens of both species, more especially the ♀♀, bear a marked general resemblance to *A. psyttalea damoclides*, Staud. The chief character by which this resemblance is obtained seems to be the markedly greater average size and roundness of the spot within the discoidal cell of the fore wing. I have therefore measured both the length and breadth of this spot in a number of specimens from South Africa, East Africa, and Uganda.

The results are appended in the following table:—

* Nov. Zool. x, p. 504. † P. Z. S. 1891, p. 633.
‡ P Z. S. 1888, p. 91.

	No. of specimens measured.	Discocellular spot average. Length.	Discocellular spot average. Breadth.		No. of specimens measured.	Discocellular spot average. Length.	Discocellular spot average. Breadth.
			S. Africa (S. of the Limpopo).				
A. echeria, Stoll.	12	2.26 mm.	1.13 mm.	*A. albimaculata*, Butler.	22	2.13 mm.	1.02 mm.
			B. E. Africa (E. of the Rift Valley).				
A. echeria jacksoni, Sharpe.	3	3.73 mm.	1.46 mm.	*A. albimaculata*, *f.* intermediate to *hanningtoni*, Butler.	5	3.32 mm.	1.52 mm.
			E. and N.E. of the Victoria Nyanza.				
A. echeria jacksoni, Sharpe.	85	4.049 mm.	1.525 mm.	*A. albimaculata hanningtoni*, Butler.	30	3.860 mm.	1.756 mm.
			W. and N.W. of the Victoria Nyanza.				
A. echeria jacksoni, Sharpe.	23	3.947 mm.	1.704 mm.	*A. albimaculata hanningtoni*, Butler.	38	3.953 mm.	2.232 mm.

It is therefore fairly safe to say, even considering the comparatively small number of specimens measured, that there has been a marked increase in the size of this spot as we advance northward along the East Coast, and thence turn westward to the apparent limit of the area of distribution of the species. In addition to this increase in area of the spot, which is common to both species, it is fairly evident from the above table that there is an increase of a peculiar kind, the spot becoming distinctly more circular in shape as we proceed westward. As will be seen from the table, the ratio of breadth to length is appreciably greater in *both* species west of the Lake than east of it. In *A. albimaculata* this progressive increase occurs as we come up from the south, as well as from east to west.

Other points of superficial resemblance which both species share, are greater expanse of wings and much better development of submarginal spotting on the hind wing. As might be expected, the resemblance in the ♀♀ is markedly closer than in the ♂♂. The ♀ specimen of *albimaculata* from Toro, figured, shows this resemblance in an astonishing manner, and has the additional characteristic of the pale buff area at the base of the hind wing being somewhat diffused. This resemblance becomes all the more significant when we remember that *A. psyttalea* does not occur in South Africa, while it is a very dominant species in Uganda, and also occurs, but not so commonly, in British East Africa. I have not had an opportunity of comparing numbers of specimens of *A. psyttalea* from the east and west shores of the Lake, but it is undoubtedly very common, and occurs in the Wiggins collection from every locality except the more open plains.

This clear influence that the presence of one species has had upon two other closely allied ones (all being highly distasteful), seems to be one of the most striking examples of Müllerian mimicry that it is possible to imagine.

The specimens of *A. psyttalea* are themselves remarkably interesting, the species being apparently in rather an unstable condition. The majority of the specimens, especially from the more eastern localities, are of the form *damoclides*, Staud., but a number from the north-west of the Lake are typical *A. psyttalea*, Plotz, from the tropical Atlantic Coast. These specimens, which are accompanied by many intermediates, are distinguished from *A. psyttalea*

damoclides by a reduced pale area at the base of, and the absence of submarginal spots on the hind wing, giving them a marked general resemblance to western forms such as *A. damocles*, Beauv. (non Fabr.), and *hecate*, Butler. *A. hecate* does itself occur sparingly on the shores of the Lake; as also another species allied to it, viz., the recently-described *A. disa*, mihi (2).* In this species all the white markings and (especially the pale area at the base of the hind wings) are even more reduced than in *hecate*.

The above is a striking case of a species acting as a model, at one and the same time as certain individuals of it are being attracted into another group. This complicated condition of mimetic association in which a species is both model and mimic at the same time is well known to be paralleled in the Neotropical region, where we find similar but still more complicated instances among the *Danainæ*, *Heliconinæ* and *Ithomiinæ*.

The specimens of *Amauris niavius*, Linn., are also deeply interesting. Whilst the specimens taken west and north-west of the Lake (with one exception from Entebbe which is intermediate in character) are all *A. niavius niavius*, the typical western forms, those from the north-eastern shores numbering about thirty specimens are nearly fifty per cent. of them intermediate to *A. niavius dominicanus*, which occurs at Mombasa.

The two chief points of distinction in the latter form are the greater extent of all the white areas and spots on both wings. The spot within the cell and subapical bar of the fore wing, together with the white basal area of the hind wing, are especially larger. In *A. niavius niavius* the discocellular spot is evanescent, and the white basal area of the hind wing seldom even reaches the extremity of the cell.

The specimens above mentioned occurring from the east of the Lake are remarkably intermediate in respect of these characters. The discocellular spot is well marked but not so large as in *dominicanus*. The subapical white bar is broader than in *niavius*, but not so broad as in *dominicanus*. The basal white area of the hind wing extends well beyond the extremity of the cell, but not nearly so far as it does in *dominicanus*.

The two instances above of two geographical forms of a species meeting and appearing in an intermediate form on

* *Loc. cit.* p. 324.

the confluent edges of their distribution is of remarkable interest.* It should help to impress upon systematists the importance of carefully considering the question of geographical races of species before making new species on slight differences.

Mimetic Groups with Danaine Models.

The black and white *Amauris niavius*, Linn., forms the model for an important group of butterflies of many families. It is evidently very abundant on the shores of the Lake. There are 118 specimens in the Wiggins Collection.

The group comprises :—

Euralia anthedon, Doub. et Hew. (14).

Hypolimnas monteironis, Druce (4 ♂ ♂, 3 ♀ ♀), of which the ♀ only is mimetic.

Papilio dardanus ♀, f. *hippocoon*, Fabr. (8), mostly from the eastern side of the Lake. The ♂ ♂ of *dardanus* (46) were common nearly everywhere.

Elymnias bammakoo, Westw. (7), all from the Western districts.

In all these forms the resemblance to the model is remarkably good, the distribution of white markings on a black or dusty ground faithfully follows those of the model and differs in much the same way from the South and East African mimics (*H. wahlbergi*, *P. cenea*, *hippocoonoides*, etc.) of *A. niavius dominicanus* as the two models do from each other.

The ♀ ♀ of *Planema godmani*, Butler (2), with the recently described *Pseudacræa tirikensis*, mihi (3), resembling it in an astonishing manner, form a subsidiary black and white group within the larger assembly having *niavius* as its model. This is, perhaps, especially the case when the insects are on the wing. At rest the *Planema*, and the *Pseudacræa* closely following its model, present the character so common in the larger Ethiopian *Acræinæ* of a black-spotted chocolate-brown triangle at the base of the hind wing on the under surface. The influence of this character on other forms and of other forms on it has

* Professor Poulton has already called attention to the case of *A. niavius* in his Presidential Address to the Entomological Society 1904. Trans. Ent. Soc. 1903, p. xciv.

already been considered by Professor Poulton.* He points out the great influence which the *Papilios* of the *zenobia* group have had in respect of this character.

It is interesting to note that this group of *Papilios* is well represented in the collection, comprising the following species:—

P. homeyeri, Plotz. . .	39	specimens.
P. cynorta, Fabr. . .	8	„
P. peculiaris, Neave . .	1	„
P. zenobia, Fabr. . .	49	„
P. gallienus, f. *whitnalli*, Neave	6	„

As Professor Poulton has pointed out, *loc. cit.* p. 489, in *P. gallienus* and its allies, the basal patch is very large and is traversed by black lines instead of spots, a character not occurring in *Planema*. In the other species the area is smaller and the lines replaced by spots. This condition reaches its extreme in *P. peculiaris*, mihi ♀, which, as will shortly be shown, is an extraordinarily close mimic of *Planema paragea*, Grose-Smith. *P. homeyeri* is also remarkable for the fact that the colour of this patch is more chocolate-brown in colour instead of golden-brown as in other species. In this respect it approaches *P. godmani* and *P. tirikensis* mentioned above.

Neptis agatha, Stoll (47), and its allies may also be not improbably members of this group. This species exhibits in common with other species of the Ethiopian region a concentration of the white markings on both wings, as Professor Poulton has already pointed out,† in contrast to the broken character of these markings in Oriental species. The flight of these species is also singularly slow and floating when undisturbed and much like that species of *Planema* and black and white *Amauris*.

The variable *A. psyttalea*, Plotz (81), from many localities was accompanied by its equally variable mimic *Hypolimnas dubius*, Pal. (9), in the more western localities.

Amauris echeria Group.

Owing to their extremely close resemblance, *A. echeria jacksoni*, Sharpe, and *A. albimaculata hanningtoni*, Butler,

* Trans. Ent. Soc. 1902, p. 488.

† *Loc. cit.* p. 467.

may be conveniently taken as the same model. They both seem common in nearly every locality except the more exposed and open plains. There were 176 specimens from various localities in the two collections, but Mr. Wiggins speaks of them as his "pet aversion," explaining that they were enormously abundant. The best mimics of these species in the collection are:—

Euralia mima, Trim. (16), mostly from the west shore of the Lake.

Papilio homeyeri, Plotz, 36 ♂♂ and 3 ♀♀, of which the latter only are mimetic.

Papilio dardanus ♀, f. *cenea*, Stoll.

This form of the ♀ did not occur in the Wiggins collection, but there are three specimens in the Harrison coll. from Nyangori, near the north-east shore of the Lake.

As Professor Poulton has pointed out, *loc. cit.* p. 485, there is a very remarkable secondary resemblance between these mimics. The ♀ of *P. homeyeri*, which does not occur in the group mentioned by him, further bears this out, having an actually closer resemblance to *Euralia mima* than to *Amauris echeria* itself. There are also in the collection some other less good mimics of *A. echeria* lying on the outskirts of the group, comprising:—*Hypolimnas dinarcha*, Hew., the forms of *Pseudacræa lucretia*, and a number of the smaller *Acræas* such as *A. servona*, Godm., *A. circeis*, Dewitz, *A. oreas*, Sharpe, and its form *albimaculata*, and especially *A. johnstoni*, f. *flavescens*. *Neptis woodwardi*, Sharpe, also comes into the same group.

For a full account of the convergence between many species of *Acræa*, including most of the above-mentioned, and species of *Amauris*, see Professor Poulton's paper, read before Section D of the British Association at Toronto, 1897.*

Limnas chrysippus Group.

Limnas chrysippus, L. (342) and *Hypolimnas misippus*, L. (160), were abundant in every locality. They were somewhat less numerous in forest districts.

Acræa encedon, L. (442), was also very common everywhere.

* Rep. Brit. Assoc. 1897, pp. 688–91.

Table of forms of above species.

L. chrysippus	*chrysippus*	136.	*H. misippus*		♀ *misippus* .	55.	*A. encedon*,	f. *encedon*		164
,,	,, *alcippoides*	16.	,,	,,	♀ *alcippoides*	7.	,,	,,	*alcippina*	8
,,	,, *alcippus* .	18.								
							,,	,,	*lycia* . .	126
,,	,, *dorippus*	163.	,,	,,	♀ *inaria* . .	36.	,,	,,	*daira* . .	124
,,	,, *albinus*	13.	,,	,,	♀ *dorippoides*	6.				

It is evident from the above numbers that Mr. Wiggins did not think it worth while to send many ♂♂ of *misippus.* Consequently the true proportion of the occurrence of this species is not obtainable. Two specimens of a new *Acræa,* both ♀♀ (*A. wigginsii,* mihi), exhibit a remarkable synaposematic resemblance to *A. encedon* and indirectly to *L. chrysippus.* The species is allied to and intermediate in many respects between *A. bomba,* Grose-Smith, and *A. anacreontica,* Grose-Smith. It differs from both these species in possessing a subapical white bar. This being probably a mimetic and not an ancestral character it is possible that the ♂♂, not yet known, may not have it.

Tirumala petiverana Group.

The black and green *Tirumala limniace petiverana,* Dbl. and Hew. (67), an abundant species, was taken in five different localities.

Of its mimic *Papilio leonidas,* Fabr., eight specimens were collected. Also two specimens of *Euxanthe crossleyi ansorgei,* R. and J., which is probably an outlying member of the group.

Melinda formosa, Godm., and *M. mercedonia,* Karsch, with the mimetic *Papilio rex,* Oberth. (hitherto considered the mimic of the Danaine), occur in both collections and are of considerable interest. Their distribution is as follows—

	N.E. Shore.	N.W. Shore.
M. formosa .	50 specimens .	—
M. mercedonia .	5 ,, .	36 specimens.

Nyangori, a few miles north-east of the Lake shore, is apparently the eastern boundary of *M. mercedonia,* and from this locality come all the five specimens recorded above. West and north-west of the Lake *mercedonia* is

common, and *formosa* does not seem to occur. There is, strange to say, not a single ♀ amongst all the specimens of *mercedonia* and only four of *formosa*.

The specimens of *Papilio rex*, eight ♂♂ and two ♀♀, in the Wiggins and Harrison collections all come from Nyangori, and are very remarkable. Only two ♂♂ are fairly typical *rex*; the other specimens especially the ♀♀ are markedly intermediate between *P. rex* and *P. mimeticus*, Rothsch. The latter species, it will be remembered, bears a strong resemblance to *M. mercedonia*. The intermediate characters are shown in the reduction in size of the spots, and in the extension of red-brown colour over the hind wings.

This fact becomes of great importance when we recollect that normal specimens of *P. rex* occur on the Kikuyu escarpment to the east, while the only specimen of *mimeticus* at present known comes from Msaromsaro north-west of the Lake. It is therefore of very great interest that, at the place where both species of *Danaines* do occur the *Papilio* should be intermediate in appearance between them; further, that where *mercedonia* exists apparently alone to the west of the Lake the *mimeticus* form should only be found; to the east, where *formosa* only occurs, *rex* should be the only form. All three species were captured at the same time of the year.

Müllerian Association of Danaines and Papilios.

In studying the last two groups one cannot fail to be struck with the fact that the mimicry has not all been on the side of the *Papilios*.

In the first place the widely distributed *Tirumala petiverana*, Dbl. and Hew., may safely be regarded as the ancestral form of the three Danaine members of the group. It extends nearly all over tropical Africa in the more wooded districts, and can only be considered a geographical race of *T. limniace*, so common in the Oriental region. Ethiopian specimens are of interest in exhibiting amongst other differences a distinct shade of reddish-brown on the under-side toward the base of the fore wing. *Melinda mercedonia*, Karsch., and *M. formosa*, Godm., on the other hand, are specialized forms with a comparatively small and local distribution. In addition to their striking red and reddish-brown colour, they differ

from *T. petiverana* in the greater length of the fore wings and in the possession of pale sulphur-yellow areas at the base of the hind wings only interrupted by dark crossing nervures. *M. formosa neumanni*, Rothsch., from Abyssinia is of great interest, and differs in several significant particulars from typical *formosa.*

These differential characters are—

(α) Slightly shorter fore wings.
(β) The presence of a V-shaped mark of pale yellow between the median nervure and first median nervule near their junction.
(γ) The brown colour of the fore wing is darker and less extensive.

This latter characteristic has already been pointed out by Mr. Walter Rothschild, Nov. Zool. 1902, p. 596.

The above characters are also of great interest in that they *all* of them show affinities to *T. limniace.* β is especially characteristic of that species.

Having therefore inquired somewhat into the ancestry of *M. mercedonia* and *formosa* it will be seen that their elongated fore wings and pale areas at the base of their hind wings are new developments and non-ancestral characters. These two points however are characteristic features not only of *Papilio rex* (in which they are specially marked) but of several other African "Swallow-tails," including *P. leonidas* itself, the mimic of *T. petiverana.*

There can be little doubt therefore that the above-mentioned characters of these Danaines have been obtained from the *Papilio.* As regards the brown colour of both *Papilio* and Danaine, on the other hand, the Danaine has almost certainly been the model. In this matter we must remember that red or reddish-brown is very rare in African *Papilios.* It occurs in the *trophonius* ♀ form of *P. cenea* and *P. ridleyanus*, White, both mimetic; also to a less extent in the golden-brown triangle at the base of the hind wing in the *zenobia* group of *Papilios* mentioned above. In Danaines, on the other hand, this colour is by no means uncommon, e.g. *Limnas, Salatura* and the allied genus *Anosia.* Further, as we have already seen, *T. petiverana* (the probable ancestor of the two Danaines in question) exhibits a tendency to brownness as compared with its Oriental allies. It is also a significant fact that

this brown colour is more marked in the ♀ of *P. rex* than in the ♂. The Danaines again have most probably formed the model for the spotting of the *Papilios*, which is not quite like that of any of its allies. Considering these facts we may cite the above group as a complete example of diaposematic resemblance.

Groups with Acræine Models.

The fine *Planema poggei*, Dewitz, occurred in fair numbers in both collections, about 20 specimens from several localities. This very striking species with its brilliant orange band on the fore wing has several interesting mimics.

First and perhaps most important of these is the *planemoides* ♀ form of *Papilio dardanus*, Brown, recently described by Mr. Roland Trimen, F.R.S.,* from a single specimen collected by Mr. Hobley of Kisumu. There are six of these ♀♀ in the collections of Messrs. Wiggins and Harrison. Amongst these is a considerable variation in the extent and completeness of the orange band on the fore wing. One specimen is remarkable for showing an intermediate character to the ♀ form of *cenea dardanus*, and the orange colour, though present, is much broken up into spots, and the basal area of the hind wing is buff coloured as in the *cenea* form instead of white as in typical *planemoides*.

Other interesting mimics of *P. poggei* in the collection are:—*Pseudacræa hobleyi* Neave, (2), in which the resemblance is best in the ♀ but remarkably close in both sexes. *Pseudacræa kuenowi neumanni*, Thur. 2. *Acræa aurivillii*, Staud. (14), synaposematic with *poggei*. *Elymnias phegea*, Fabr. (2) (also referred to by Mr. Trimen *loc. cit.*).

An outlying member of this group was recognized in the 3 ♀♀ of *Precis rauana*, Grose-Smith, which bear an orange bar across the fore wing as in the ♂♂ (14); but have a *white* discal bar instead of an orange one to the hind wing. This gives them the same general appearance as the above forms.

Planema tellus, Auriv. (9), from the western districts, is resembled by the recently described *Pseudacræa terra*, mihi (1), also from the western side of the Lake, the resemblance being astonishingly close.

* Trans. Ent. Soc. Lond. 1903, pt. I, p. xl.

All the members of a small group of peculiar interest were captured by Mr. Wiggins at Entebbe on the north-west shore of the Lake within a few days of each other.

The dull-coloured *Planema paragea*, Grose-Smith, 1 ♂ (April 5, 1903) and 1 ♀ (April 9, 1903) is the model of the group. It is mimicked by two species both recently described,* viz.:—

Pseudacræa obscura, 1 ♂, 1 ♀ (April 5, 1903), of which the ♀ is the better mimic.

Papilio gallienus peculiaris,† 1 ♀ (April 6, 1903).

This species is remarkable for its small size and sombre colour relieved by pale cream-coloured markings, thus closely resembling the model.

Remarkable evidence of the coincidence of mimetic forms in time and space is here afforded by the fact that three such widely-separated species, all very closely resembling one another, should all have been captured on the same spot and on nearly the same date.

The plentiful *Acræa sotikensis*, Sharpe (37), has only one mimic in the collection but that a remarkable one, viz. *Mimacræa poultoni*, mihi (3). The resemblance on both surfaces is extremely close. The group of spots on the underside at the base of the hind wing and the characteristically marked hind margin of the *Acræa* is faithfully represented on the Lycænid.

A very large number of small orange-red and black *Acræas*, forming a synaposematic group occur in the collection comprising:—

Acræa viridia, Hew. (1287).
„ *alicia*, Sharpe (147).
„ *uvui*, Grose-Smith (5).

And the more outlying *A. serena*, Fabr. (1451).

They are mimicked by the Lycænid *Telipna carnuta*, Hew. (2).

A similar group is that in which the common *Pardopsis*

* *loc. cit.* pp. 333 and 342.

† N.B.—Dr. Karl Jordan, of the Tring Museum, informs me that this species may not improbably prove to be a mimetic form of the ♀ of *cynorta*, Fabr., the ♂ ♂ (not represented in the Wiggins coll.) being hardly distinguishable from that species.

punctatissima, Boisd. (150), is the model. Two species of Lycænidæ are associated with it, viz.:—

Pentila petreia, Hew. (24).
„ *clarensis*, Neave (10).

Note.—Prof. Poulton informs me that he discovered two specimens of *P. amenaida*, Hew., placed among the *Acræas* in the Hope Collection by Professor Westwood.

Another synaposematic group among the Acræinæ consists of the larger red and black species, viz.:—

A. egina, Cram. (21).
A. perenna, Dbl. and Hew. (42).
A. zetes, Linn. (7).
A. pharsalus, Ward (8).
A. orina f. *orinata*, Oberth. (6).

These species belong to no less than three different subdivisions of the *Acræinæ*.

These species—especially *A. egina*—are resembled closely by *Papilio ridleyanus*, White (4).

Pseudacræa boisduvali, Dbl., though not in the Wiggins or Harrison collection, was obtained by Mr. A. W. Hobley in the same district, and also closely mimics *A. egina*.

Monura zingha, Cram. (1), is probably an outlying member of this red and black group.

It is by no means improbable that the outlying gigantic mimic, *Papilio antimachus*, Drury, will also ultimately be found here.

Mimicry in other Groups.

Atella phalantha (144), so common all over Africa, occurs plentifully in the collection, together with its mimic, *Pseudargynnis hegemone*, Godt. (35), from many of the same localities. As is so often the case, the resemblance is closer in the ♀ than in the ♂.

Mimicry among the Pierinæ.

Three very differently coloured species of *Mylothris* form the models of three well-marked groups.

I. *Mylothris jacksoni*, E. M. Sharpe, with white fore wings and sulphur-yellow hind wings, is only represented by a

single specimen in the Wiggins collection, but it appears to be common in other collections from the same area.

It is mimicked by :—

A yellow hind-winged ♀ form of *Belenois zochalia*, f. *formosa*, Butler, of which there are three specimens. Of the ordinary form of the ♀ there are 2, and 44 ♂ ♂.

Phrissura lasti, Grose-Smith (1).

Phrissura phœbe, Butler, (2), in which the resemblance is on the upper surface alone.

II. *Mylothris agathina* (139), a very common species, is white with blackish marginal spots on the upperside, while beneath, the apex of fore wings and whole of hind wings are ochreous; furthermore the base of underside fore wing is largely, and that of hind wing slightly, diffused with orange-red.

These characters on both surfaces are faithfully imitated by :—

Belenois thysa, Hopff. (14).

Pinacopteryx rubrocostalis, Lanz. (14).

Phrissura phœbe (2), mimics *M. agathina* on the under surface only, thus entering Group II. as well as I.

III. *Mylothris yulii*, Butler (25), and *Mylothris poppea*, Cram. (40), form a synaposematic pair, both being silvery-white with black marginal markings and both having the base of the fore-wing underside flushed with ochreous.

They are closely mimicked by :—

Phrissura sylvia, Fabr. (17).

Pinacopteryx dixeyi, Neave (12).

The latter species is only represented in the collections from the Toro country on the eastern slopes of the Ruwenzori Mts., some distance west of the Lake. The other species occur both east and west of the Lake.

The extremely abundant yellow and black *Terias*—

T. brigitta, Cram. (89)

T. desjardinsi, f. *regularis*, Boisd. (45)

T. senegalensis (70)

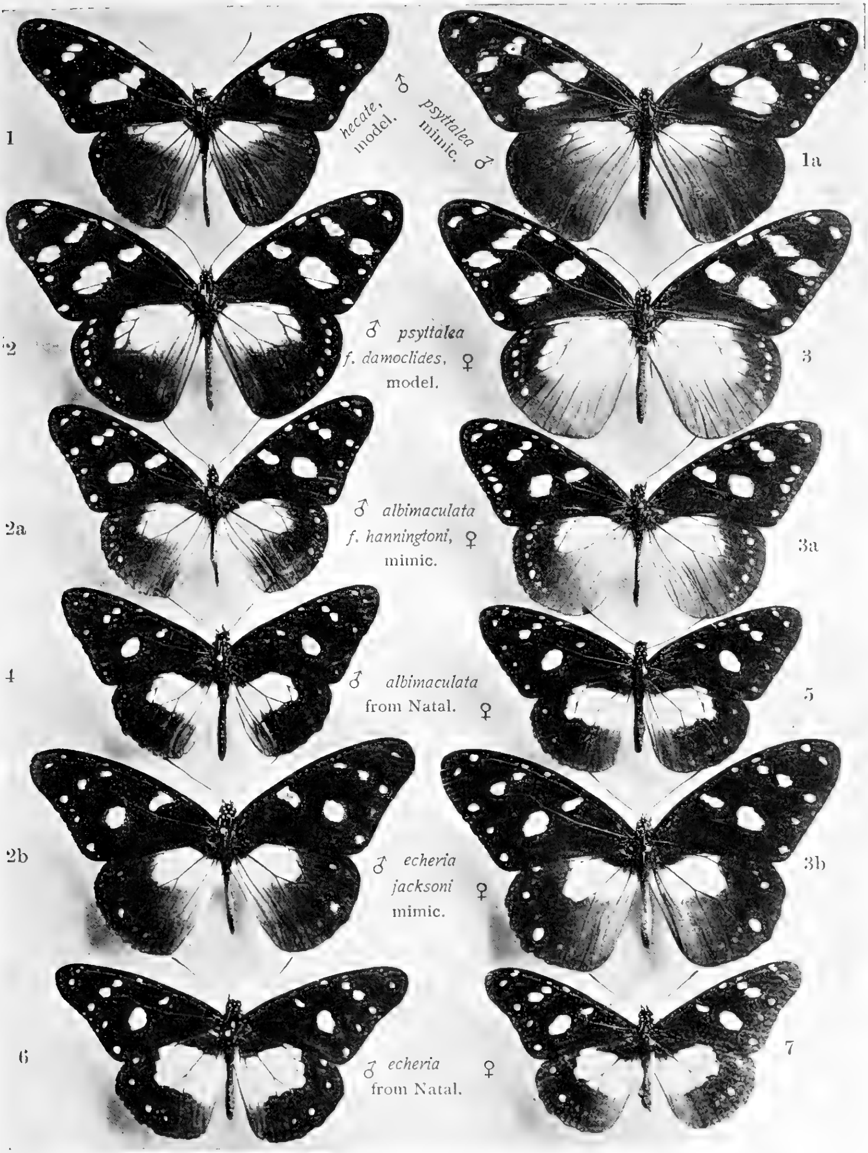
are closely mimicked by the Lycænid, *Teriomima xantha*, Grose-Smith (4).

Seasonal Forms.

Pressure of time, owing to my sudden departure to N.E. Rhodesia in January 1904, prevented me from studying the seasonal forms in this collection as much as I should have wished. They seem to be mainly of interest in the following particular. Just as on the equator the seasons are not nearly so well marked as in South Africa, so the seasonal forms are not so well marked, while intermediates are more common.

The most interesting specimens are several fine dry season *Precis cœlestina*, Dewitz, and some remarkable intermediate and dry specimens of *P. archesia*, Godt.

In conclusion, I should like to express my unbounded gratitude to Professor Poulton, D.Sc., F.R.S., of the Hope Department, Oxford University Museum, at whose suggestion the work was undertaken, and who has given me the inestimable benefit of his unique knowledge of these subjects.



Alfred Robinson, phot. Andre & Sleigh, Ltd.

Synaposematic resemblance between species of the Danaine genus *Amauris*, near the Victoria Nyanza.

Alfred Robinson, phot. Andre & Sleigh, Ltd.

Acræine, Nymphaline, Elymniine and Papilionine mimics of Planema poggei, from near the Victoria Nyanza.

Explanation of Plates.

Plate IX.

Fig. 1. *Amauris hecate*, Butler, ♂. From Toro, Western Uganda.

1*a*. *Amauris psyttalea psyttalea*, Plotz, ♂. From Toro. Exhibiting a great general resemblance to Fig. 1 by reason of the reduction of pale basal area and submarginal spots on the hind wing as compared with Fig. 3.

2. *Amauris psyttalea damoclides*, Staud., ♂.

3. " " " " ♀.

From the N.E. shore of the Lake.

2*a*. *Amauris albimaculata hanningtoni*, Butler, ♂.

3*a*. " " " " ♀.

From Toro. Exhibiting a great resemblance to the foregoing by reason of the large spot in the discoidal cell of the fore wing, and in the marked submarginal spotting of the hind wing.

4. *Amauris albimaculata albimaculata*, Butler, ♂.

5. " " " " ♀.

From Malvern, near Durban, S.A. Exhibiting a strong contrast to the preceding Uganda specimens.

2*b*. *Amauris echeria jacksoni*, Sharpe, ♂.

3*b*. " " " " ♀.

From Entebbe on the W. shore of the Lake. Remarkable for large size and well-marked spot in the discoidal cell as compared with the next species.

6. *Amauris echeria echeria*, Stoll, ♂.

7. " " " " ♀.

♂ from Malvern near Durban, S.A. ♀ from Durban.

Plate X.

Fig. 1. *Planema poggei*, Dewitz, ♂. From N.E. of the Lake. Remarkable for its brilliant orange discal bar on the fore wing, and white bar on the hind wing.

2. *Acræa aurivillii*, Staud., ♂. Synaposematic with the above. From N.W. shore of the Lake.

3. *Pseudacræa kuenowi neumanni*, Thur., ♂. From N.W. shore of the Lake. Bears a marvellous resemblance on *both* surfaces to Fig. 1.

4. *Pseudacræa hobleyi*, Neave, ♂. From Entebbe, N.W. shore of the Lake.

5. *Precis rauana*, Grose-Smith, ♂.

6. " " " ♀.

♂ from N.E., ♀ from N.W. shore of the Lake. The ♀ only is mimetic.

7. *Elymnias bammakoo*, Westw., ♂. From N.W. shore of the Lake.

8. *Papilio dardanus* ♀ f. *planemoides*, Trim. This magnificent form, with its orange discal bar to the fore wing and white basal area to the hind wing, bears a very close resemblance to the model.

Plate XI.

Fig. 1. *Melinda formosa*, Godm., ♂.
1*a*. „ „ „ ♀.
♂ from Kikuyu escarpment. ♀ from N.E. shore of the Lake.
2. *Papilio rex*, Oberth., ♂.
2*a*. „ „ „ ♀.
From the Kikuyu escarpment.

Plate XII.

Fig. 3. *Papilio rex*, f. intermediate to ♂ *mimeticus*, Rothsch.
3*a*. „ „ „ „ „ ♀ „ „
From N.E. shore of the Lake. From this locality both the Danaines, *M. formosa* and *M. mercedonia*, occur.
4. *Melinda mercedonia*, Karsch., ♂.
From the N.W. shore of the Lake.
5. *Papilio mimeticus*, Rothsch., ♀.
From the N.W. shore of the Lake.

Horace Knight, del.

André & Sleigh, Ltd.

Synaposematic resemblance between Danainæ and Papilioninæ from the East of the Victoria Nyanza.

Horace Knight, del.

André & Sleigh, Ltd

Synaposematic resemblance between Danainæ and Papilioninæ from the Northern shore of the Victoria Nyanza.

XV. Mimetic Forms of *Papilio dardanus* (*merope*) and *Acræa johnstoni*. By Edward B. Poulton, D. Sc., M.A., Oxon., Hon. LL.D., Princeton, F.R.S., Hope Professor of Zoology in the University of Oxford, Fellow of Jesus College, Oxford.

[Read June 6, 1906.]

Plates XVII–XXII.

A. Mimetic forms of *Papilio Dardanus*, Brown.

I. *Synepigonic Group bred in* 1904 *by G. F. Leigh, F.E.S., from a* trophonius ♀ *form of* P. dardanus *subspecies* cenea, *near Durban.*

This piece of work is an interesting and important addition to the breeding experiments upon *P. dardanus* undertaken by Mr. Leigh in 1902 and 1903. (Trans. Ent. Soc., Lond. 1904, p. 677.) As a result of this latest inquiry the *trophonius* ♀ form has for the first time been bred from a parent of the same form.

On May 4, 1904, Mr. G. F. Leigh observed a *trophonius* female laying eggs on the food-plant, at Bellair, five miles from Durban, Natal. He collected the eggs but the parent butterfly escaped. From these eggs Mr. Leigh succeeded in breeding six males and seven females. Of these all the males and five of the females are represented about two-fifths of the natural size on Plate XVII, Figs. 1–11. The dates of emergence are given in the explanation of Plate XVII (pp. 312, 313), so it is not necessary to repeat them here. The two unfigured females were in both cases *cenea* forms:—one greatly deformed and shrivelled (pupated June 30, 1904, emerged July 30: the ninth to emerge); one not included in Mr. Leigh's consignment (it was the twelfth to emerge).

(*a*) *The males.*

The six males of this interesting synepigonic series are represented on Plate XVII, Figs. 1–6. If compared with

the account (in Trans. Ent. Soc. Lond. 1904, p. 684) of the equal number of males in the family bred in 1902 by Mr. G. F. Leigh, it will be seen that the latter possess as a whole far darker submarginal bands on the hind-wing. A single male (Plate XVII, Fig. 6) and that by far the darkest of the 1904 family is about as dark as one of the medium specimens of 1902. The other five are far less dark than any except the dwarfed "*specimen* 6." It is not necessary to describe and compare the condition of the submarginal bands, inasmuch as the whole series is figured, and this is a character which can be reproduced with great fidelity, and can be as well compared in somewhat reduced figures as in those which represent the natural size.

The hind-wings of these males, less heavily marked as compared with the 1902 and 1903 groups, probably exhibit seasonal differences, and the same explanation is even more certain for the under-side coloration, which is darker and more uniform in the specimens here described.

It will be noticed that the inner border of the black margin of the fore-wing is strongly serrated in Fig. 5, less so in Figs. 4 and 6. This serration is characteristic of both male and female in the ancestral *Papilio meriones* of Madagascar, but strangely enough it does not reappear in the most ancestral of the continental males which I have had the opportunity of examining. I do not find it in *P. antinorii* (3 males), *P. polytrophus* (5 males), or in *P. merope* from the west coast. It appears however in a small proportion of the males from the northern end of the Victoria Nyanza and in the southern and eastern *cenea*. In the latter case it is to be found not uncommonly among the captured specimens as well as among those that have been bred. It is certainly remarkable that this ancestral feature should on the continental area be chiefly found in the most highly specialized of all the sub-species,—*cenea* of the south and south-east.

(β) *The females.*

The *trophonius* offspring (Plate XVII, Fig. 7) is seen to be a perfectly normal example of the southern type. As regards the *cenea* forms, the relative development of buff and white in the spots of the fore-wings may be shown by comparison with the earlier family classified on p. 681 of Trans. Ent. Soc. Lond. 1904.

Plate XVII, Fig. 8, about the same as No. III on p. 681.
" " " 9 }
" " " 10 } " " " " Nos. IV–V " "
" " " 11 }
The unfigured cripple } " " " " " I–II " "

The two *cenea* represented in Figs. 8 and 11, on Plate XVII, show the influence of *trophonius* parentage (see description of Figures, p. 313).

In the latter pages of this memoir these 11 specimens, both male and female, will be often referred to and compared with other forms.

II. *Papilio dardanus* ♀ f. *trimeni*, new form.

In his Presidential Address to the Entomological Society of London in 1898 (Proc. 1897, pp. lxxxviii, lxxxix) Mr. Roland Trimen, F.R.S., described a remarkable form of the female *dardanus*, sub-species *tibullus*, from Zanzibar, in the Hope Department. After expressing the opinion that the West African *dionysos* was the least modified as compared with the male of all the various tail-less continental female forms known until that time,* he went on to describe the specimen from Zanzibar as "a much closer approximation to the masculine coloration. In this female the tranverse trace of black in the fore-wings is even fainter than in the *dionysos* form, and the colour of the wide pale spaces and the hind-marginal spots in all the wings is almost exactly of the pale creamy-yellowish tint of the male *P. cenea*; and on the under-side, while the pale yellowish of the fore-wings is better divided by blackish than on the upper-side, the colouring of the hind-wings corresponds much more nearly to that of the male than in any other female I have seen—the characteristic break in the submarginal brownish band being moreover very complete and wide. There can be no doubt that in this specimen we have a marked case of reversion to the original colouring of the female, but it is unaccompanied by any inclination towards the recovery of the lost tail of the hind-wings." In the same address (p. lxxxviii) the distinguished African naturalist expresses the opinion that "we may not unreasonably hope to dis-

* Speaking of *dionysos*, Mr. Trimen quotes his earlier paper in Trans. Ent. Soc. Lond. 1874. The reference is erroneously given as p. 178 : it should be p. 148.

cover, at some point in the wide territories between Abyssinia and Zanzibar, females of the *Merope*-group exhibiting stages intermediate between the long-tailed mimetic females of *P. antinorii* and the entirely tail-less ones of *P. cenea*."

It was reasonable not to attempt to name this primitive variety while it remained as a single example; but now that it has been discovered in large numbers as one of the female forms of the sub-species *polytrophus*, Jordan, on the Kikuyu Escarpment, the case is different. It is one of the most instructive if not actually the most instructive of all the female forms of *dardanus*; and I propose to call it *trimeni*, in honour of the great naturalist who solved the mystery, and laid a firm foundation for all future work upon the most interesting and complex example of mimicry as yet known throughout the world.*

The specimen referred to by Mr. Trimen is here represented on a slightly reduced scale on Plate XIX, Fig. 1. In Plate XVIII, Fig. 1, one of the smaller *trimeni* forms from the Kikuyu Escarpment is represented of about the natural size. Of these there are four in the Hope Department. Judging from these four specimens the ground colour is sometimes yellow, exactly like that of the male (1), sometimes of a rather paler shade (2), and sometimes a little darker (1).

(*a*) *Occasional occurrence of rudimentary "tails" to the hind-wing of* trimeni *and* hippocoon.

The *trimeni* form frequently possesses ancestral characters additional to those described in the Presidential Address. The most interesting of these supplies the confirmation of Mr. Trimen's prediction that stages would be found "intermediate between the long-tailed mimetic females of *P. antinorii* and the entirely tail-less ones of *P. cenea*." The specimen represented on Plate XVIII, Fig. 1, is seen to have a small but distinct rudimentary "tail," containing an extension of the third median nervule. This nervule also enters the tail in the male, showing that the rudimentary tail of the female is entirely homologous with that of the other sex. The other three specimens of *polytrophus* ♀ f. *trimeni* do not exhibit this feature, but it is

* It is perhaps unnecessary to say that I allude to the great monograph in Trans. Linn. Soc., vol. xxvi, 1870, Pt. III, 1869, p. 497.

possessed by an interesting example, to be described below (see p. 290), showing the origin of *trophonius* from *trimeni*. It is also possessed by two examples of the sub-species *merope* ♀ f. *hippocoon* in the National Collection. These specimens, both from the west coast, are represented in Plate XIX, Figs. 2 and 3.

(β) *Prominence of submarginal pale spots in hind-wing of* trimeni, *etc.*

Another primitive feature usually characteristic of *trimeni* is the large size and prominence of the submarginal pale spots in the black border of the hind-wing. These spots are of course persistent traces of the yellow ground colour of the male and unmodified female enclosed between the two black bands parallel with the hind-margin of the hind-wing. The band of ground colour is widest and most prominent between the root of the "tail" and the "inner gap," as will be seen by a glance at Figs. 1–6 on Plate XVII. Furthermore this especially prominent patch is widest immediately on the inner side of the root of the "tail," because it is here continuous with the ground colour in the "inner gap" (Plate XVII, Figs. 1–5) or enters the bay by which the closed gap is indicated (Fig. 6). It is precisely in this region, between the second and third median nervules, that the pair of submarginal spots even in the most specialized female forms often tend to be largest and most conspicuous. This is well seen in the *cenea* forms represented on Plate XVII, Figs. 8 and 11; and in the *hippocoon* shown on Plate XIX, Figs. 2 and 3. In the more primitive *trimeni* we expect to find and we do find these tendencies more marked and accompanied by a far higher degree of development of the whole series of paired submarginal spots on the hind-wing. The special size of the pair marking the position of the inner gap is well seen in the *tibullus trimeni* represented on Plate XIX, Fig. 1, and even better in the *polytrophus trimeni* of Plate XVIII, Fig. 1. In this latter the two enlarged spots have fused into a single and prominent patch. The development of the series of submarginal spots in *trimeni* is however far better seen in three specimens of this form of the sub-species *polytrophus* in the Hope Department,—specimens which in other respects were less instructive than that represented on Plate XVIII, Fig 1.

We can at once understand by the study of the examples

of *trimeni* figured on Plate XVIII, Fig. 1, and XIX, Fig. 1, and by comparison with the *hippocoon* forms on the same plates (XVIII 2, XIX 2–3), why it is that the submarginal yellow ground colour should be represented in the mimetic females by a *pair of pale spots* between each pair of nervules. It is evidently because the marginal development of black was brought about not only by a growth in width of the two marginal black bands of the male (Plate XVII, Figs. 1–6), but was also aided to an important extent by the appearance of black inter-nervular streaks. These naturally cut the ground colour still persisting between each pair of nervules into two halves.

(γ) *Traces of costal and inner gaps in black margin of hind-wing of* trimeni, *etc.*

Apart from the indication of the "inner gap" afforded by the special development of the corresponding pair of pale submarginal spots, other distinct traces of both gaps are among the primitive features of *trimeni.* They are especially strongly developed in the specimen shown in Plate XVIII, Fig. 1. The "costal gap" is remarkably clear in the figure, while the site of the "inner gap" is rendered visible by two faint yellow streaks passing outwards into the broad black margin. They are better seen in the right hind-wing of Fig. 1. The *trimeni* represented on Plate XIX, Fig. 1, is a ♀ form of the east coast sub-species *tibullus* in which the black band of the male is more developed than elsewhere, while the gaps are reduced to a minimum (Trans. Ent. Soc. Lond. 1904, p. 683). Nevertheless the "costal gap" can be clearly recognized. It is seen in Fig. 1 that the inner border of the black margin is not curved parallel with its outer border forming the edge of the wing but is made up of two straight lines meeting in an obtuse angle. This angle is the point where the central yellow invades the black margin most deeply and represents the costal gap of the male. This identification will be at once admitted when Fig. 1 on Plate XVIII is compared with Fig. 1 on XIX. The squarish shape thus originating persists in many examples of the more specialized female forms. It may be distinctly seen on the two *hippocoon* (Figs. 7, 8) and three of the *cenea* (Figs. 5, 6, 10) forms represented on Plate XXXI of Trans. Ent. Soc. 1904; and in the present memoir in *trophonius* represented on Fig. 7 of Plate XVII, and the

cenea on Fig. 11 of the same Plate. It is remarkably distinct in the *polytrophus* ♀ f. *hippocoon* shown on Plate XVIII, Fig. 2, although barely recognizable in the same forms from the west coast seen in Figs. 2 and 3 of Plate XIX.

III. *Papilio dardanus,* sub-species *merope* ♀ f. *dionysos,* Doubl.

Before proceeding to consider the origin of the mimetic female forms of *dardanus* it is necessary to say a few words of this remarkable and primitive variety which is not uncommon on the west coast. It is very probable that it also occurs among the wonderful series of *polytrophus* females from the Kikuyu Escarpment, but I have not yet met with an example.

In *dionysos* the hind-wings are those of the *merope* ♀ f. *trophonius* except that they are of a distinctly paler tint and thus nearer to *trimeni.* The costal gap is also very strongly marked. The fore-wings possess the black and white coloration of *hippocoon,* but with a primitive diminution of the black markings which is very like *trimeni.* In fact in one specimen (Cameroons: Cutter: 1869) in the Hope Department the oblique bar dividing the two chief white markings of the fore-wing is even less developed than in any of the five specimens of *trimeni* in the same collection. It is probable that *dionysos* was an early variant from *trimeni,* presenting a mixture of the characters which in other proportions were to be selected into *trophonius* on the one hand and *hippocoon* on the other.

IV. *The sub-species of* Papilio dardanus (= merope).

Before discussing the origin of the mimetic female forms it is necessary to consider the division of *dardanus* into sub-species. Dr. Karl Jordan* has examined 509 males and 270 females in the Tring Zoological Museum. Excluding the forms from N.E. Africa and Madagascar and only considering the males Dr. Jordan finds south of Sierra Leone five sub-species distinguished chiefly by the extent of black on the hind-wings. Differences in sex-organs are confined to the valve-edges. Dr. Jordan's five sub-species are as follows:—

* Der Gegensatz zwischen geographischer und nichtgeographischer Variation. Zeitsch. f. wissenschaft. Zool., Bd. lxxxiii. Dr. F. A. Dixey has very kindly lent me for the purpose of this memoir an abstract which he has prepared of this interesting paper.

(1) *P. cenea.* S. Africa. Transition to next form in geographical position and morphological character is complete.
(2) *P. tibullus.* Delagoa Bay northwards to Mombasa; west limit unknown, but occurs in Uganda.
(3) *P. polytrophus.* B. E. Africa.
(4) Transitional forms from Victoria Nyanza.
(5) *P. dardanus dardanus.* Unyoro to west coast. Congo specimens are larger, as in some other cases.

Dr. Jordan furthermore states that *P. dardanus* is not sharply marked off into geographical forms. East and west coast examples can be distinguished, but neither assemblage is a complete unit. It is significant that the valve-process is generally present in eastern and absent from western forms.

In the following pages I have followed Dr. Jordan's conclusions and terminology with the single exception that I have called the fifth sub-species *dardanus merope* instead of *dardanus dardanus.*

V. *The origin of the mimetic female forms of* Papilio dardanus *from the* ♀ f. trimeni.

There can be little doubt that all the well-known mimetic females of *dardanus* as well as the latest discovery *planemoides* originated by modification of this primitive female form, either directly or by the combination and development of characters on their way to produce other forms. I propose to consider the evolution of these forms in the order of specialization, beginning with the most primitive :—

(1) *Hippocoon.* The relationship of *hippocoon* to *trimeni* is at once seen by comparing Fig. 2 with Fig. 1 on Plate XVIII. The transformation is remarkably direct and simple, consisting merely in the greater intensity and sharpness of black markings already distinctly indicated in *trimeni*, and in the alteration of the pale yellow tint of the latter into white. There are four examples of this form from the Escarpment in the Hope Department. The other three are fairly represented by the figure of the fourth on Plate XVIII, Fig. 2, and it is rather surprising that none of them possess an indication of rudimentary "tails." It cannot be doubted however that *hippocoon* is by far

the most primitive of the mimetic female forms of *dardanus*, and I have been deeply interested to find well-marked rudimentary "tails" on two specimens from the west coast. These examples of the sub-species *merope* ♀ f. *hippocoon* exist in the National Collection, the "tails" being pronounced in one (Plate XIX, Fig. 2), distinct in the other (Fig. 3). By kind permission of the authorities I am able to submit the reproductions, referred to above, of Mr. Alfred Robinson's beautiful photograph, made in the Oxford University Museum.

The sporadic occurrence of this ancestral feature in association with precisely that form which still retains the most primitive pattern is a difficulty to be surmounted by those who have been inclined to minimize or even to deny the occasional cropping-up by reversion of long-lost characters.

The name *hippocoonoides* has been given by Haase to this form in the eastern and southern sub-species *tibullus* and *cenea*. This seems to me a most unnecessarily complex and inconvenient procedure. The *trophonius* of the western sub-species *merope* is at least as different from that of the southern *cenea* as are the two forms of *hippocoon* from the same areas. It is pretty certain indeed that each female form of every sub-species has certain peculiarities and is not exactly like the same form of any other sub-species. But this is quite sufficiently indicated by prefixing to the female form name the sub-specific name. *Papilio dardanus* sub-species *merope* ♀ f. *hippocoon* of the west coast is naturally different from *P. dardanus* sub-species *cenea* ♀ f. *hippocoon* from Natal, and it is quite unnecessary to express this by turning the last name into *hippocoonoides*. To do so without making corresponding changes in the other forms is inconsistent; to be consistent in this respect is immensely to increase and to increase uselessly an already tremendous terminology.

The *hippocoon* forms are everywhere mimics of the abundant and conspicuous Danaines, *Amauris niavius* of the west and its sub-species *dominicanus* of the east coast and the south. They also exhibit a strong secondary mimetic approach to their Nymphaline co-mimics *Euralia anthedon* of the west and *E. wahlbergi* of the east and south (Trans. Ent. Soc., Lond., 1902, p. 486). The *hippocoon* form is probably dominant in all the sub-species of *dardanus* except *cenea* and perhaps *polytrophus*; and it is present in fair proportion in both these.

(2) *Trophonius.* This form possesses the pattern of *hippocoon,* but white has been replaced by fulvous over the great continuous patch occupying most of the hind- and a large part of the fore-wing. The remaining pale markings are white, so that the yellow of *trimeni* in part originated white and in part fulvous,—a more complex change than that which produced *hippocoon.* Considering the identity of pattern I first supposed that *trophonius* arose from *hippocoon* instead of having an independent origin in the *trimeni.* Although the former view may be correct, the latter is I think more probable, being strongly supported by an interesting specimen from the Kikuyu Escarpment, in the Hope Department. In this butterfly the great patch is fulvous except upon the distal border of the part upon the fore-wing. This border, together with all the other pale markings on both wings, is not white like *hippocoon,* but retains the yellow of *trimeni.* The specimen furthermore possesses a rudimentary "tail" nearly as much developed as that of the *trimeni* represented on Plate XVIII, Fig. 1, while the sub-marginal yellow spots of the hind-wing are very large and prominent, far more so than in the particular specimen of *trimeni* just referred to. This specimen, with its primitive features, strongly supports the direct independent origin of *trophonius* from *trimeni,* the most convincing evidence being supplied by the pale markings which had not been converted into white, but remained of the ancestral yellow.

The *trophonius* form at any rate of the *merope* sub-species appears to be more unstable and is probably a more recent development than either of the other mimetic female forms *hippocoon* and *planemoides.* A specimen in the Hope Department (Angola: Rogers: 1873) presents a very primitive form of the oblique black bar dividing the two chief pale spaces of the fore-wing. It is even less developed than in a specimen of *dionysos* in the same collection and much like that of the *tibullus trimeni* represented on Plate XIX, Fig. 1. *Merope trophonius* is very apt to appear as a variety in which the fulvous tint overspreads the whole of the pale markings of both wings. One of the two *polytrophus trophonius* forms at Oxford is of this variety. It is moreover a very poor mimic of *Limnas chrysippus* as compared with the smaller more deeply-coloured *trophonius* of the *cenea* sub-species (Plate XVII, Fig. 7). It is also noteworthy that the *merope trophonius*

does not, so far as I am aware, present a variety with white hind-wings like the forms of *Limnas chrysippus*, var. *alcippus*, universal on the west coast.

Trophonius forms, although probably always relatively rare, occur in all five sub-species distinguished by Dr. Jordan.

(3) *Cenea.* Here too it is almost certain that the female form developed direct from *trimeni*, the ancestral yellow ground colour being transformed into buff without first becoming white. The evidence is similar to that advanced in the case of the last female form, but is stronger, inasmuch as there is not in *cenea* that close resemblance to the pattern of *hippocoon* which is borne by *trophonius.* Comparing the *trimeni* on Plate XVIII, Fig. 1, with the *hippocoon* in Fig. 2, and the *cenea* in Fig. 3,—all *polytrophus* forms from the Escarpment,—it is at once seen that the change from the apical half of the fore-wing of the ancestral form to that of *cenea* is nearly as simple as the change to *hippocoon.* For the rest of the pattern, *cenea* requires only a more widespread invasion of black than *hippocoon.* There are six examples of *polytrophus* ♀ f. *cenea* in the Hope Department, and all exhibit primitive characteristics in the pale tint of the chief patch of the hind-wing. In none is this buff like the Danaine models, but it is pale yellowish like *trimeni* in three, and pale yellowish with a faintly brownish tinge in the other three, including the specimen represented on Plate XVIII, Fig. 3. In five cases the chief spot of the fore-wing follows the tint of the hind-wing patch, in the sixth the chief spot is white. The other spots on fore- and hind-wings are generally pale yellowish, sometimes white. It is quite clear that we have in three specimens a stage in the transformation of the ancestral yellow tint into buff. It is of interest to observe that the *pattern* of the *cenea* form is completely attained in three specimens whose pale colour remains entirely ancestral. Not one of the six specimens exhibits rudimentary "tails," although the sub-marginal hind-wing spots are strongly developed. (Plate XVIII, Fig. 3.)

The *cenea* ♀ form is dominant in the sub-species *cenea* of the south and south-east, and common in *polytrophus* of the Kikuyu Escarpment. It occurs, but more rarely than *hippocoon*, in other parts of British East Africa, as a female form of *tibullus* and of the intermediate forms round

the Victoria Nyanza. It is unknown and probably entirely wanting from the sub-species *merope* on the west coast, but it may perhaps occur at the extreme eastern development of the sub-species in Uganda. Its distribution is thus co-extensive with that of its Danaine models the forms of *Amauris echeria* and *albimaculata*.

(*a*) *Evidence of diaposematic mimicry between the* cenea ♀ *f. of* P. dardanus *and two species of the Danaine genus* Amauris.

It has been shown on p. 286 that the squarish shape of the large pale patch on the hind-wing of the female forms of *dardanus* is extremely ancestral, and the question arises as to whether *Amauris echeria* and *albimaculata* have not mimicked and indeed exaggerated this feature in the *Papilio* which in other respects has mimicked them. There are many reasons in favour of diaposematic relationship between *Danaine* and *Papilio*. The squarish patch in the two species of *Amauris*, although far more marked than in the *cenea* form, is in all probability a recent development. It shows remarkable synaposematic sensitiveness, losing much of its characteristic sharpness and angularity in the presence of other species of the same genus. This change may be seen by a glance at Mr. S. A. Neave's Plate IX in the present volume. *Amauris albimaculata* (♂ Fig. 2*a*, ♀ Fig. 3*a*) shows this change in the presence of *Amauris psyttalea*, form *damoclides*, ♂ Fig. 2, ♀ Fig. 3. Compare the shape of the patch in the two sexes of *albimaculata*, with that of the same species from Natal far beyond the influence of *damoclides*,—♂ Fig. 4, ♀ Fig. 5. *Amauris echeria* is also changed in the same direction by the presence of the same model, as may be seen by comparing ♂ Fig. 2*b* and ♀ Fig. 3*b* under the influence of *damoclides* (♂ Fig. 2, ♀ Fig. 3), with the same species from Natal—♂ Fig. 6, ♀ Fig. 7. *Amauris lobengula* (Plate XXII, Fig. 1), closely allied to *A. echeria* and probably ancestral to it, because less peculiar in the genus, possesses a larger hind-wing patch in which the square shape is not nearly so marked. It is in fact almost precisely similar in shape to that of the *trimeni* form shown on Plate XIX, Fig. 1, and the *hippocoon* on Plate XVIII, Fig. 2. The exaggeration of the feature in *Amauris albimaculata* and *echeria* is no reason against the hypothesis that it has been derived by mimicry. In the great majority of the forms of *Acræa*

johnstoni, undoubtedly mimetic in this respect, we meet with a still further exaggeration of the same character, the outer corner of the square being pulled out so as to form the most distinctive feature of the wing (see Plate XXI, Figs. 1*b*, 3*a*, and 4*a*, Plate XXII, Figs. 1*a* and 2*a*). That diaposematic resemblance is apt to arise between the *Papilionidæ* and the most distasteful groups in the same region has been shown by Dr. F. A. Dixey (Trans. Ent. Soc. Lond. 1896, p. 75; also 1894, p. 298) as regards S. America, and recently in a very striking manner by Mr. S. A. Neave (Trans. Ent. Soc. Lond. 1906, pp. 216–218) as regards certain other African species.

(4) *Planemoides.* Until Mr. C. A. Wiggins presented his splendid series of captures made in 1903 near the N.E. and N.W. shores of Lake Victoria Nyanza, there only existed in the Hope Department a single specimen labelled "Angola; Rogers, 1873." This specimen was, as far as I am aware, up to 1903, the unique representative of *planemoides* in European collections. There are at the present moment no less than ten examples of the form, or of intermediates between it and other forms, at Oxford,* so that it is now possible to compare *planemoides* with the other mimetic females of *dardanus* and to attempt to assign its place and suggest its past history.

It is convenient first to describe the intermediate specimens.

(*a*) ♀ *form intermediate between* cenea *and* planemoides.

The specimen here described is represented on Plate XX, Fig. 1. The discal patch of the hind-wing is not white as in *planemoides* but nearer to the buff of *cenea,* although with a faintly reddish-brown tinge which may perhaps indicate some influence of *trophonius.* The submarginal light spots are more developed than is usual in *planemoides,* although the example represented in Fig. 4 does not differ widely in this respect. While the hind-wings more nearly resemble the ♀ f. *cenea,* the fore-wings are on the whole much nearer to *planemoides,* as may be inferred by

* Some of these do not belong to the Hope Collection, but are the property of Mr. A. H. Harrison. They are however available for study and comparison, and two of them are represented on Plate XX, Figs. 1, 4. No less than five out of the ten examples are figured on the plates accompanying the present memoir, and a sixth by Mr. S. A. Neave on Plate X, Fig. 8.

comparing the intermediate form (Plate XX, Fig. 1) with *planemoides* represented below it (Fig. 2), and with the ♀ f. *cenea*, represented on Plate XVIII, Fig. 3. The colour of the markings is the deep rich tint of *planemoides*, not the far paler shade of *cenea.* The fusion of the three spots grouped round the outer end of the cell, and the shape of the marking thus produced, is almost precisely as in the specimen shown on Plate XX, Fig. 2; while the spreading outwards and downwards of the chief spot (below the cell) reproduces the inner marginal end of the band of *planemoides.* The central part of the band is wanting, but a tendency towards fusion can be detected in the figure and is far more evident on the specimen. The *planemoides* selected for comparison with this intermediate specimen, and shown in Fig. 2, is unusual owing to the overspreading of the white patch of the hind-wing by greyish scales. It is also a little abnormal and suggests transition towards the specimen above described (Fig. 1) in the separation of the spot within the fore-wing cell from the fulvous band (compare Figs. 3 and 4) and also in the comparative narrowness of the band itself, which is especially marked in the central portion where the discontinuity appears in Fig. 1. Figures 1 and 2 considered alone would suggest the origin of *planemoides* from the *cenea* form.

(β) ♀ *form intermediate between* hippocoon *and* planemoides.

The insect represented in Fig. 3 shows a tendency towards the *hippocoon* form in the extension of the fulvous band (representing of course the white of *hippocoon*) towards the base of the fore-wing, along the inner margin, as well as in the trace of an invasion of dark ground colour dividing the band at its centre. The effect is to produce a considerable approximation to the fore-wing pattern of *hippocoon* (Plate XVIII, Fig 2) or even more of *trimeni* (Plate XVIII, Fig. 1). Fig 3, on Plate XX, compared with the fine example of typical *planemoides* represented in Fig. 4 suggests the origin of the latter from *hippocoon* or *trimeni.*

(γ) ♀ *form intermediate between* trophonius *and* planemoides.

Only quite recently Mr. Harry Eltringham, F.E.S., has kindly shown me a beautiful coloured representation of a specimen from Entebbe which is intermediate between

planemoides and a *trophonius* of the western or *merope* type.* The latter strongly preponderates: the hind-wings are entirely those of *trophonius.* The fore-wings exhibit the fulvous area of *planemoides* spreading inwards along the inner margin and there becoming continuous with the fulvous area of *trophonius.* The pattern of the fore-wing is very like that represented on Plate XX, Fig. 3, but the fulvous area is somewhat larger and much less invaded by dark ground colour. The apical half of the fore-wing is typical *planemoides,* closely resembling that of the figure just quoted. This specimen taken alone would suggest the origin of *planemoides* from *trophonius.*

(δ) *Intermediates between* planemoides *and other mimetic female forms of* dardanus, *not ancestral but due to first crosses between female of one form and male representing another form.*

The three intermediate examples described above ($\alpha, \beta,$ and γ) suggest the origin of *planemoides* from the fully developed *cenea, hippocoon* and *trophonius* respectively; and yet it is unreasonable to suppose that *planemoides* arose from more than one of the other female forms. We are thus driven to believe that such intermediates are not necessarily ancestral and to inquire what other significance they may possess. Here we derive the greatest assistance from Mr. G. F. Leigh's breeding experiment in which it has been seen (see pp. 283, 313) that the *cenea* offspring of a *trophonius* parent exhibited distinct traces of the latter form. It will be remembered that this influence was evident in the deeper tint of the hind-wing patch in one specimen (Plate XVII, Fig. 8) and the inner marginal markings on the fore-wing of another (Fig. 11).† The intermediates described in this section of the paper are probably always the result of first crosses between females of one form and males bearing the tendencies of other female forms. We are compelled to believe that in later generations their female offspring

* Easily distinguished from the *trophonius* of the south and east by its greater size, by the *marked* invasion of the margin of the fulvous area on the hind-wing by internervular radii, and by the much paler shade of the fulvous areas.

† A faint trace of the same marking is to be seen in the *cenea* offspring of a *trophonius* bred by Mr. Leigh in 1903. It can be just detected in the reduced representation on Fig. 11, Plate XXXI, Trans. Ent. Soc. London, 1904.

would not remain intermediate, but would split up, in accordance with the Mendelian conception, into the parent forms; and we can thus understand the comparative rarity of intermediates. But while this is almost certainly true of the sub-species of *dardanus* in the W., S., and on the E. coast of Africa, where the specialization of the female forms has been carried to a high pitch, it is probably not equally true of the sub-species *polytrophus* of the Kikuyu Escarpment.

(ε) *Probable origin of* planemoides *from early variants of* trimeni.

The abundance of intermediates of all kinds among the females of *polytrophus* and the relative numbers of the ancestral form *trimeni* indicate a near approach to the origin of the diverse female forms. It is probable indeed that first-cross intermediates between the specialized forms themselves would split up into the parent forms on the Escarpment as in other parts of Africa; but it is by no means equally certain that the intermediates between each of them and their primitive ancestor *trimeni* would behave in this manner. Only thus does it seem possible to explain the relative abundance on the Escarpment of intermediates almost always exhibiting primitive characteristics, viz. some approach to *trimeni.*

It would be of the highest interest to breed any of the sub-species of *dardanus* through several generations: especially is this desirable in the case of *polytrophus,* which is certain to yield results of the utmost importance from many points of view.

It is probable that *planemoides* arose from *trimeni* by a combination of the varieties which were to produce *cenea, hippocoon,* and *trophonius.* The size and shape of the white hind-wing patch probably arose from varieties on the way to *cenea,* its whiteness from those which were forming *hippocoon,* while the fulvous tint of the fore-wing was a utilization in another direction of the characteristic colouring of *trophonius.*

The argument made use of with regard to *planemoides* applies to all the other mimetic female forms; for intermediates between them occasionally occur probably in every sub-species and in all parts of the area of distribution. But while such varieties are not to be looked upon as ancestral, the case is very different with the Escarpment

forms. Every one of the six *polytrophus cenea* which have come under my observation are primitive in the tint of the pale markings and we must assume that in this case we are in presence of a truly ancestral feature.

(ζ) *An interesting gynandromorphic specimen of the* ♀ f. planemoides.

Although the male and the diverse female forms of the southern *P. dardanus*—the sub-species *cenea*—have been shown by direct evidence to be a single species by the important breeding experiments of Mr. G. F. Leigh, F.E.S.,* the same proof is unfortunately still wanting in other parts of Africa. It is therefore very satisfactory that other evidence has become available in the case of the most recently discovered form *planemoides.* This is in part supplied by the existence of intermediates between it and the other female forms of *dardanus,* two of which are shown on Figs. 1 and 3 on Plate XX. But still more striking evidence is supplied by a remarkable gynandromorphic specimen collected by Mr. T. T. Behrens, R.E., and represented on Plate XVIII, Fig. 4. The butterfly was obtained in 1902–3 on the west shore of the Victoria Nyanza between Entebbe and the mouth of the Kageru River. The admixture of male colouring, which is confined to the left wings, is very well represented in the figure, except upon the white patch of the hind-wing, where the pale yellow streaks could not be differentiated from the white background by photographic means. If the black ground colour of the left hind-wing be compared with that of the right, it is seen that three submarginal irregular areas of a deeper shade are present on the former wing but absent from the latter. These represent the submarginal band of the male while the spaces between them are the costal and inner gaps. The yellow male scales pass through the costal gap as an almost continuous streak, while they are developed in small scattered masses in the neighbourhood of the inner gap. The yellow scales reach the extreme margin of the hind-wing in the concavities of the scalloped border, as in the male, while the yellow of the two concavities nearest the anal angle

* Published in Trans. Ent. Soc. 1904, p. 677, and in the present memoir.

(omitting from consideration the one that has been accidentally injured) possesses a pale brownish edging also characteristic of the male.

In the fore-wing the yellow male streaks and patches are strongly developed on the disc below the cell. It is deeply interesting to observe how sharply cut off they are when, crossing the lower part of the fulvous band, they reach the black border. We are driven to infer that this portion of the border almost precisely corresponds in the two sexes and that the black border of this and other female forms is inherited unchanged from an ancestor like the male. In fact this character carries us further back than the ancestral *trimeni* form (Plate XVIII, Fig. 1) in which the male border has already been greatly modified. It is to be observed furthermore that the abrupt termination of the yellow streaks confers upon the black border a sharpness of outline entirely wanting in the female form, as is at once seen when the right and left sides are compared. Opposite to the middle of the hind margin the black border is invaded by an outward extension of the fulvous band—due to that part of it which represents the subapical bar of the *hippocoon* ♀ form (compare Figs. 2 and 4 on Plate XVIII). Here the ancestral male border has been much reduced, and in the gynandromorphic specimen the site of the invading fulvous concavity is in part covered by grey scales quite distinct from the yellow ones on those parts of the wing surface which are yellow in the male. The photographic method however only imperfectly renders the difference.

(η) *Mimetic relationships and distribution of* planemoides.

This beautiful form, only recently recognized as a mimic of *Planema poggei* by Trimen and Neave (Proc. Ent. Soc. Lond., Oct. 7, 1903,) is not known to occur as a female form of any sub-species of *dardanus* except *merope* (= *dardanus dardanus*). The occurrence at Taveta of a fine variety of *Acræa johnstoni* (Plate XXI, Fig. 2 *a*) strongly convergent towards *planemoides* renders it probable that this latter exists in the neighbourhood, perhaps as one of the female forms of the sub-species *tibullus*. The immense increase in our knowledge of *planemoides* during the last two or three years encourages the hope that we shall at no distant date be fully acquainted with its range.

B. Mimetic forms of *Acræa johnstoni*, Godman.

Introductory.—In the following section the attempt will be made to show that the whole series of diverse forms which have given to this species its long synonymic list has arisen through the development of mimetic likeness to several distinct models, both Danaine and Acræine. The form-names suggested by Oberthür * have been followed throughout, *Acræa toruna*, Grose-Smith, being regarded as a form of *semifulvescens*, Oberth. In a later part of the section facts will be brought forward which appear to prove that this protean butterfly is not only conspecific with *fallax*, Rogenh. (= *kilimandjara*, Oberth.), as Aurivillius suggests, but also with Godart's species, *lycoa.*

I owe the opportunity of writing this part of the present memoir to my kind friend, the Rev. K. St. Aubyn Rogers, M.A., of Wadham College, Oxford, who has presented to the University Collection the deeply interesting series of models and mimics represented on Plate XX. The whole of the butterflies there represented together with other examples of the same mimetic forms were captured on the slopes of Kilimanjaro in 1905. In addition to this extensive material Mr. St. Aubyn Rogers has presented many examples of *A. johnstoni* from Taita and Taveta in British East Africa, including the fine and remarkable variety from the last-named locality, represented on Plate XXII, Fig. 2*a*. The series of models and mimics would however have lacked completeness if other kind friends had not also afforded valuable help:—Mr. Guy A. K. Marshall sending me an extreme south-eastern form (Plate XXII, Figs. 1*a*, 1*b*) with its model (Fig. 1); and Mr. C. A. Wiggins the extreme western mimetic form (Plate XXII, Fig. 3*a*) with the model (Fig. 3) from the same district.

The mimetic resemblance of the commonest forms of *A. johnstoni* (*proteina* and *flavescens*) to Danaine butterflies of the genus *Amauris* was suggested by the present writer in 1897.† Although greatly impressed by the likeness of Acræine to Danaine, I was then quite unaware of the existence of this wonderful range of forms and of the

* Etudes d'Entomologie : Dix-septième Livr. : Avril 1893.

† "Theories of Mimicry, as illustrated by African Butterflies," read before Section D of the British Association at Toronto, Aug. 20, 1897. Abstract in Report of the Toronto Meeting, pp. 688–691.

striking example of Müllerian mimicry which it was to supply.

I. *Mimetic forms of* Acræa johnstoni, *Godman.*

It is now proposed to consider the various often widely-separated forms of *johnstoni* in the probable order of their evolution in time, and to point out the models in each case.

(1) *Acræa johnstoni*, Godm., form *proteina*, Oberth. Oberthür (Etudes D'Entomologie: Dix-septième Livr.: Avril 1893: Pl. II, Fig. 14) considers the variety with white spots in the fore-wing and a squarish pale buff discal patch in the hind-wing as the typical form of the species; and it is probably more ancestral than any other. It appears to be much more abundant than the buff-spotted form *flavescens*, and also to have a wider range. The most southern examples in the Hope Collection, viz. three specimens sent to me by my kind friend Mr. Guy A. K. Marshall from Chirinda Forest, Gazaland, in S.E. Rhodesia (4000 feet), are all of this form, and it is also far more numerous than any other in the Rev. K. St. Aubyn Rogers' series from the Kilimanjaro district, as also in the series from the Tiriki Hills on the N.E. shores of the Victoria Nyanza (5100 feet) kindly given me by Mr. C. A. Wiggins.

The *proteina* form is an obvious and beautiful mimic of *Amauris albimaculata* and the white-spotted forms of *Amauris echeria*. Its synaposematic sensitiveness is well seen in Mr. Marshall's specimens from Chirinda in which the squarish discal patch of the hind-wing is unusually large, clearly as an approach to *Amauris lobengula* (Plate XXII, Fig. 1), one of the dominant Danaines of this locality. The discal expansion is more pronounced in the female *Acræa* (Fig. 1*b*) than in the two males, one of which is represented in Fig. 1*a*. The more perfect mimetic likeness of the female is an example of the well-known and widely applicable principle explained by A. R. Wallace.*

The resemblance of *proteina* to the Danaine model is far less perfect on the under-side, although the spots of the fore-wing and the patch of the hind-wing are still the prominent features. The ground colour in the marginal

* Trans. Linn. Soc., vol. xxv, 1866, Pt. I, 1865, p. 22. See also Poulton in Linn. Soc. Journ. Zool., vol. xxvi, pp. 580–582.

part of the hind-wing and the apical part of the fore-wing is marked by alternating dark and light stripes,—dark veins, paler ground colour and again darker internervular radii. This is certainly the conspicuous feature of the insect during prolonged rest with closed wings hanging downwards, and it is an appearance characteristic of many *Acræinæ*.* Hence in complete rest the prominent characters are synaposematic with other *Acræinæ*; during flight and in brief rests with wings open the characters are synaposematic with the genus *Amauris*.

Oberthür's form *semialbescens* (l. c., Plate III, Fig. 29) with white spots on the fore-wings and reddish-brown hind-wings bearing a paler discal patch of the same colour, may be looked upon as an exceptional variety of *proteina*. It is of much interest as an example of the variational material out of which natural selection has probably produced such mimetic forms as *fulvescens* (Plate XXI Fig. 4*a*), and *toruna* (Plate XXII, Fig. 3*a*.)

(2) *Acræa johnstoni*, form *flavescens*, Oberthür (l. c., Pl. I, f. 4). This form differs in the spots of the fore-wing being buff instead of white. It is an obvious mimic of the buff-spotted forms of *Amauris echeria*. Every gradational shade between pronounced buff and the pure white of *proteina* is to be found. A good intermediate example is figured on Plate XXI, Fig. 1*b*, but the methods of photography do not at present enable us to distinguish between these pale tints. The remarks upon the under-side colouring of *proteina* apply equally to *flavescens*.

(3) *Acræa johnstoni*, form *semifulvescens*, Oberthür (l. c., Pl. II, f. 19). This is the form of the species described by Godman from Kilimanjaro, and therefore from the systematist's point of view the type of the species. From every other point of view it is evidently highly specialized —a comparatively modern offshoot from the ancestral *Amauris*-mimicking forms *proteina* or *flavescens*. The change has been brought about by selection in the direction of other models, Acræine in place of Danaine. There are at least three different sub-forms included under *semi-*

* It is also reproduced in the mimicry of *Acræinæ*, e. g. in the males of certain species of *Pseudacræa*. In the magnificent W. African Lycænid, *Epitola honorius*, F., the portions of the under-side exposed in prolonged rest are beautifully mimetic of this Acræine appearance, not only as regards the radiate markings but also in the characteristic group of black spots at the base of the hind-wing.

fulvescens, each of the three mimicking a different Acræine species or form.

(*a*) The most primitive sub-form is typical *semifulvescens* as it occurs on Kilimanjaro,—represented in Plate XXI, Fig. 3*a*. The whole of the fore-wings, within the zigzag line of the four spots, is bright fulvous, while the discal patch of the hind-wings is pale yellowish. Thus is produced a considerable superficial resemblance to *Planema quadricolor*,* Rogenh., from the same mountain (Fig. 3). The zigzag line of pale spots bordering the fulvous area of the fore-wings represents the black margined fulvous band which borders the deep rich brown of the *Planema*. The relative position of darker and lighter shades is the same, although the inner half of the surface is much brighter in the mimic than in the model. In the hind-wing the *semifulvescens* form has a far larger pale area than the *Planema*, in which the rich brown black-spotted triangular basal patch of the under-side is reproduced upon the upper. The discal band of the *Planema*, if smaller than the squarish patch of the mimic, is brighter in tint, being white instead of pale yellow. In one specimen of *semifulvescens* from Kilimanjaro the black ground colour has greatly encroached upon the basal margin of the discal patch, leaving a pale band which closely approximates to the form of the marking in the *Planema*.

(β) The second sub-form of *semifulvescens* (Plate XXII, Fig. 2*a*) is a splendid member of the group of mimics clustered round *Planema poggei* (Fig. 2) as the central model,—the combination of which so many members have been described and figured by Mr. S. A. Neave (Trans. Ent. Soc. 1906, p. 218: Plate X). It differs from Oberthür's form (*a*) in the restriction of the fulvous area of the fore-wing to the neighbourhood of the zigzag line of pale spots (compare Plate XXII, Fig. 2*a*, with XXI, Fig. 3*a*). On the distal side of each spot as in *semifulvescens* the ground colour of the wing is black; but it is also very dark brown, almost black, on the proximal side of the innermost spot, except along the costa, where the fulvous tint extends nearly to the base of the wing. The discal patch of the hind-wing is moreover white instead of

* This *Planema*, of which a male and a female were presented by Rev. K. St. Aubyn Rogers, was new to the Hope Collection, and is unrepresented in the National Collection. It was kindly named for me from a photograph by Prof. Chr. Aurivillius.

pale buff. The resemblance of this striking and beautiful form is also promoted by its size; for it is one of the largest specimens of *johnstoni* which I have ever seen. As in so many other cases this mimic is an even closer approach to a co-mimic than it is to the primary model. And of all the species which are grouped round *Planema poggei* there can be no doubt that its resemblance is strongest to the *planemoides* female of *Papilio dardanus* (Plate XX, Figs. 2, 4). I do not know of this latter from Taveta where the (β) form of *semifulvescens* was collected by Mr. St. Aubyn Rogers; but *planemoides* exists in the A. H. Harrison collection from Nairobi, so that its existence in the neighbourhood of Kilimanjaro and Taveta is at any rate probable; and the same may be said of *Planema poggei*, the primary model, also labelled Nairobi in the same collection.

In both (α) and (β) sub-forms of *semifulvescens* the fulvous part of the fore-wing under-side would be hidden by the hind in the attitude of prolonged rest, so that the appearence becomes synaposematic with many of the smaller *Acræinæ* rather than with the particular *Planema* models. On the other hand, in flight and probably during brief rest between successive flights the basal part of the fore-wing under-side would contribute to the visible appearance and serve to reinforce the resemblance to the Planemas.

(γ) The third sub-form of *semifulvescens* is the *toruna* form (Plate XXII, Fig. 3*a*), described under that name from Toro, W. Uganda, by Mr. H. Grose-Smith. There can be no doubt I think that this is a further development of the form described by Oberthür from Kilimanjaro —a modification brought about by mimetic resemblance to another *Planema* model,—*P. latifasciata*, E. M. Sharpe (Plate XXII, Fig. 3). It is altogether a much more perfect mimic of this *Planema* than *semifulvescens* (α) is of the allied *P. quadricolor*. The rich brown colour of the basal half of the fore-wing is here alike in model and mimic, while the zigzag row of four spots tend in *toruna* to fuse and generally completely fuse into a zigzag fulvous band somewhat resembling but more irregular than that of the *Planema* model. In *P. latifasciata* the black inner border of the fulvous band is far more feebly developed than in *P. quadricolor*, so that the absence of this border in *toruna* does not greatly detract from the likeness. On the other hand, the fulvous band itself is far wider and more con-

spicuous in *latifasciata*, and this is well matched except in form by the mimic. In fresh specimens moreover the ground colour of both wings in the Toro model and mimic is of a distinctly brownish shade of black, wanting in the dark ground of the more eastern pair. The discal band of the hind-wing in *P. latifasciata* (Plate XXII, Fig. 3) is fulvous and broader than the white band of *quadricolor* (Plate XXI, Fig. 3): the triangular basal brown patch of the hind-wing under-side is reproduced above in both species of *Planema*, but the black spots are indistinctly seen on the upper-side of *latifasciata*, while the chief members of the group are conspicuous, being in fact reproduced on the upper-side of *quadricolor*. In *toruna* the discal patch on the hind-wing is fulvous, and the effect at a little distance is singularly like that of the model. It is however produced in a different way; for the uniform bright fulvous tint of *latifasciata* is imitated by a fusion of two distinct colour elements in *toruna*,—viz. the paler fulvous ground colour of the patch and the deep fulvous internervular and intracellular rays which traverse it. The shape of the discal patch has also been modified into close resemblance to the band of *latifasciata*, although a trace of the angle, so well known and conspicuous in the forms of *johnstoni*, remains as a guide, indicating the path of evolution. The basal invasion by deep rich brown of the pale patch on the hind-wing suggests the basal triangular area of the *Planema* model. On the under-side the patterns of both model and mimic are reproduced in paler shades, still maintaining their close resemblance. The discal band of the hind-wing of *Planema* and the corresponding patch of the *Acræa* are white, and in the latter the characteristic squarish shape is far more prominent than on the upper-side. The basal spots of the hind-wing under-side which are so concentrated towards the base in other forms of *johnstoni* are here moved outwards and are placed upon and along the borders of a rich brown triangular area resembling but much smaller than that of the model. The *toruna* form of *johnstoni* is one of the most interesting of the mimetic appearances developed by this remarkable and protean species.

(4) *Acræa johnstoni*, form *fulvescens*, Oberthür (l. c., Pl. II, f. 21). This, the last of a wonderful series, is one of the most remarkable, the black ground colour persisting only as

a narrow margin widened at the apex of the fore-wing (Plate XXI, Fig. 4*a*). The whole of the rest of the surface of both wings is bright fulvous, with the four spots of the fore-wing and the squarish patch of the hind-wing visible (especially the former) as a paler shade of the same colour. At a little distance and during flight these markings would become inconspicuous, and the butterfly would closely resemble a small specimen of the form of *Limnas chrysippus* dominant in British East Africa, viz. the *dorippus* form (= *klugii*), without the black and white apex to the fore-wing (Plate XXI, Fig. 4). On the under-side the resemblance of *fulvescens* to the primary model is less close because of the absence of the distinct black margin so conspicuous on the upper-side. But this very appearance, together with a radially striped pattern caused by the alternation of dark veins and brighter ground colour, and the increased paleness of the marginal part of the hind-wing and the apical area of the fore-wing, promote a deuterosynaposematic resemblance to another Acræine mimetic of *dorippus*,—the *daira* form of *Acræa encedon.* These two Acræas are moreover of nearly the same size, while the Danaine primary model is of course a far larger butterfly. The chief basal spots of the hind-wing under-side are not black and prominent but dark fulvous and therefore inconspicuous, in this case producing an appearance suggestive of *dorippus*, and unlike any of the forms of *encedon* in which the black spots are so conspicuous a feature.

II. *Acræa johnstoni*, Godm., and *A. fallax*, Rogenh., the eastern forms of *A. lycoa*, Godt.

The three forms which it is here proposed to unite under a single species are thus grouped by Aurivillius: *—

"109. Acræa johnstoni, Godm.; *telekiana*, Rogenh.; *fulvescens*, Oberth.; *semifulvescens*, Oberth.: ab. Octobalia, Karsch.; ab. (et var.) confusa, Rogenh.; *johnstoni*, Butl.; *proteina*, Oberth.; *flavescens*, Oberth.; *semialbescens*, Oberth.

"110. A. fallax, Rogenh., forma præcedentis ?; *Kilimandjara*, Oberth.

"111. A. lycoa, God.; ab. ♀ Butleri, n. ab. *lycoa*, var. ♀ Butl."

* Rhop. Æthiop. 1898, pp. 114, 115. References are omitted from the quotation. The italics indicate synonyms.

We see therefore that Aurivillius keeps *A. lycoa* distinct, while he suggests that *A. fallax* (*kilimandjara*) may be a form of *johnstoni*. I believe that he is right in this last opinion, although positive proof can only be gained by breeding; but the facts set forth below render it certain that *fallax* is the eastern form of *lycoa*. If Aurivillius is right in his association of *fallax* it will inevitably follow that the whole series of varied forms must fall under Godart's species,—*lycoa*.

Acræa lycoa of the tropical west coast is distinguished from *A. johnstoni* by the following characteristics:—

(1) The large size of the four spots on the fore-wing and the tendency of the subapical pair to fuse and form a subapical bar: the tendency of the more interior pair similarly to form a patch extending from below the end of the cell towards but not quite reaching the posterior angle of the wing. The spots are, however, sometimes separate, although much larger and more nearly approximated than in *johnstoni*.

(2) The pronounced sexual dimorphism of which no trace can be found in *johnstoni*. The males of *lycoa* have a much browner ground colour than the females, especially in the hind-wing, while the spots of the fore-wing are pale buff instead of white and are sometimes evanescent. Furthermore the white discal patch of the hind-wing is unrepresented in those males I have had the opportunity of examining, while the development of the internervular radii is correspondingly increased.

(3) The apex of the fore-wing of *lycoa* is more broadly rounded and the costal margin more curved than in *johnstoni*. The outline of the wing between the apex and the posterior angle is straight or even convex in the females, straight or very slightly concave in the males. In *A. johnstoni* it is probably always concave, although sometimes very slightly so.

(4) The basal black spots on hind-wing under-side are smaller in *lycoa* and less concentrated towards the extreme base of the wing. The spot in the base of the cell with the two spots on the costal side of it forms in *lycoa* a characteristic approximately equilateral triangle. Owing to the greater concentration of spots the corresponding triangle in *johnstoni* is nearly always isosceles with its base towards the root of the wing. It is moreover less conspicuous as a feature in the wing of this latter form.

(5) The discal *white* patch on the hind-wing of the female *lycoa* is somewhat larger than in *johnstoni*: moreover it is rounded and not subquadrangular as is the *buff* patch of the eastern form, although rare exceptions both as regards contour and tint are not wanting in the latter. The rounded margin of this patch in the female *lycoa* is more invaded by internervular radii than in *johnstoni*, and consequently less sharply defined. Outside the discal patch the strong development of these dark radii contrasted with the paler (greyish or rarely brown) ground colour produces a very different effect from the almost uniformly dark appearance of the corresponding area in *johnstoni*.

When we reach the western part of Uganda, in the uplands of Toro, at a height of 7–9000 feet, *lycoa* is still a dominant *Acræa*. The only male I have seen resembles the western form except that there is a slight tendency towards the development of a buff discal patch in the hind-wing. Some of the females resemble those of the west coast except that the white discal patch is very slightly smaller: in others the four white spots of the fore-wing are widely separated and smaller, approaching the condition of *johnstoni*, while in these very individuals the discal patch of the hind-wing is smaller and more sharply defined. In all other respects the western characters described above are still maintained.

Passing still further east to the N.W. shore of the Victoria Nyanza at Entebbe, we find that the males have now gained the four widely separated buff spots in the fore-wing, not nearly so distinct and sharply defined as those of *johnstoni*, but otherwise very similar. Many individuals have a small trace of the buff discal patch. All the females I have seen resemble the most *johnstoni*-like of those from Toro, except for the tint of the discal patch of the hind-wing, which has become a very pale buff. These females are nearly indistinguishable from the *kilimandjara* figured by Oberthür * (=*fallax*, Rogenh.). Owing to the kindness of my friend, Mr. T. T. Behrens, R.E., I have had the opportunity of examining a pair of this form from the Anglo-German boundary west of the Lake, but not more than sixty miles from it. While the female resembles those from Entebbe, the male has a far

* Etudes D'Entomologie: Dix-septième Livr.: Avr. 1893, Pl. II, f. 17.

more marked but very imperfectly defined buff discal patch.

We now pass to the N.E. shore of the lake. The Hope Department possesses an interesting series of specimens kindly presented by Mr. C. A. Wiggins. They come from the Tiriki Hills, 5100 feet, twenty miles N. of Kisumu. In the more defined buff discal patch of the hind-wing the three males are a further advance in the direction of the *fallax* form than that reached by any male I have seen from further west. In the four females the discal patch is slightly less pale than that of any as yet mentioned, while the rest of the hind-wing is more uniformly dark. They are in fact almost precisely similar to females of the *kilimandjara* form (see Plate XXI, Fig. 2*a*) from the mountain after which it was named by Oberthür; only differing in the *smaller* size of the discal patch and its slightly paler tint. A single female obtained by Mr. Wiggins at Kakamega's (5500 ft.) near Mumias on the Uganda Railway, about fifteen miles N.E. of Kisumu, is of the same type, but the patch is even smaller and very slightly deeper in tint. Mr. C. A. Wiggins' Nyanza and Toro specimens were identified as forms of *A. lycoa* by Mr. S. A. Neave (Nov. Zool., vol. xi, March 1904, pp. 348, 349), and I find that the same forms from Toro and Nyangori are labelled "*lycoa* ?" by Miss E. M. Sharpe in the A. H. Harrison Collection.

We now pass to the most eastern specimens I have examined, viz. those kindly sent me by Rev. K. St. Aubyn Rogers from Taita, Taveta, and Kilimanjaro. In these forms the buff-spotted males with an enlarged discal patch of pronounced buff (Plate XXI, Fig. 1*a*) mimic the buff-spotted and buff-patched *Amauris echeria*, while the white-spotted females (Plate XXI, Fig. 2*a*) with slightly paler buff patches, also enlarged as compared with the Nyanza forms, mimic *Amauris albimaculata* and the white-spotted forms of *A. echeria*. They are certainly Rogenhofer's *fallax* and Oberthür's *kilimandjara*. They are equally undoubtedly the eastern forms of *Acræa lycoa*, modified by the mimicry of Danaines not known on the west coast. The sexual dimorphism of *lycoa* persists in *fallax*, and remains of the same kind though very different in degree; for, as pointed out above, the males bear buff spots on the fore-wing and the females white, while the discal patch is paler in the latter sex. The *johnstoni* of

Godman (*proteina* of Oberthür) differs from *fallax* and *lycoa* in that it is not sexually dimorphic. I have found males and females both present in the *semifulvescens* form and the white-spotted Amauris-like forms. Both sexes would probably be found in a sufficient series of any variety. It also differs in possessing squarish as compared with a rounded discal hind-wing patch, which is also more sharply defined because less invaded by internervular radii. In *fallax* the contour of the fore-wing has greatly approximated from *lycoa* towards *johnstoni*, but the apex is still slightly more broadly rounded, and the costa of the fore-wing rather more bent. On the other hand, a concavity between the apex and the posterior angle, although faint or absent in the females, has now become distinct in the males of *fallax*,—as distinct as in *johnstoni*. In this respect and the more uniformly dark ground colour of the hind-wing outside the discal patch these extreme eastern forms of *lycoa* show an approach to *johnstoni*. The basal spots of the hind-wing under-side remain however precisely those of the western *lycoa*.

A most curious change in *lycoa* as we advance from west to east is the shrinkage of the discal patch to a minimum at the N.E. of the Victoria Nyanza and its subsequent slight expansion further east.

In the collections I have already mentioned supplied by the generosity of many friends *Acræa johnstoni* was first found (in about equal numbers) accompanying the forms of *lycoa* (*fallax*) in the Tiriki Hills; and in far greater numbers at Kilimanjaro, Taveta, and Taita. The great majority are easily separated from the *lycoa* (*fallax*) forms by the characters already mentioned but intermediate individuals certainly occur. The most striking of these appeared among four males sent to me from the Kenya District by my friends Mr. and Mrs. S. L. Hinde. Of three specimens captured on February 8, 1903, at Fort Hall (about 4000 feet) two are obvious *johnstoni* while the third possesses a well-defined buff patch intermediate in outline between *fallax* and *johnstoni*. The basal spots of the hind-wing under-side resemble those of *fallax*. On the other hand, the spots of the fore-wing are white and not buff as in the males of *fallax*. The fourth specimen, captured above the Goura River (5–7000 feet) February 21, 1903, is somewhat nearer to *fallax* and the fore-wing spots are buff. A very fine intermediate example also exists in

the National Collection. In view of these intermediate specimens, and the variation in all the distinguishing characters observed when a sufficiently long series of *johnstoni* are examined I do not doubt that Aurivillius is correct in suggesting that *fallax* is conspecific with *johnstoni.* Strong support is also afforded to Aurivillius' suggestion by the observations of Rev. K. St. Aubyn Rogers, who knows both *johnstoni* and *fallax* in life in their natural habitat and looks upon them as a single species. It has been shown here that *fallax* is undoubtedly the eastern form of *lycoa.* It therefore becomes extremely probable that the whole wonderful series of forms—many of them totally unlike—associated under the name *johnstoni,* or as it was still more appropriately named by Oberthür, *proteina,* are all of them specifically identical with Godart's species *lycoa.* Furthermore, this remarkable series must be still further extended to include the *toruna* of Grose-Smith.

In conclusion, it is possible to attempt to reconstruct the history of the changes through which *lycoa* and its descendants have passed. It is probable that the male of the western *lycoa* represents the ancestral form of the whole group,—a semi-transparent fuscous and brownish *Acræa* with ill-defined markings. As regards the semi-transparency it is noteworthy that the character tends to crop up not uncommonly in the most modified form *johnstoni,* where it is often seen in the discal patch of the hind-wing. The female of the western *lycoa* became modified by synaposematic approach to the black and white species of the Danaine genus *Amauris* on the west coast. The same is substantially true of the species in Western Uganda where the black and white *Amauris* are still predominant and have even drawn the *echeria* and *albimaculata* types of their own genus after them. (See S. A. Neave in Trans. Ent. Soc. 1906, pp. 208–210.) As we go further east however these latter types become themselves predominant, and the *fallax* forms of *lycoa* follow them, the males becoming strongly mimetic and approaching the buff-spotted Danaine models, while the females still retain the ancestral colour and resemble those that are white-spotted. As regards the hind-wing both sexes gain a buff discal patch similar in colour but not in shape to the models. Finally, from the most strongly-marked of these eastern forms with the deepest shade of ground

colour there probably arose still more perfect mimics of the same models in *proteina* and *flavescens*, the two forms of *johnstoni* which are nearest to *fallax*. It is to be observed that the change in the shape of the fore-wing which occurred as *fallax* gave rise to *johnstoni* is in the direction of the form of the Danaine and *Planema* models. *Johnstoni* once formed, variation in other directions, guided by natural selection, led to the mimicry of various additional Danaine and Acræine models: — of *Limnas chrysippus*, var. *dorippus*, of *Planema quadricolor*, *Planema latifasciata*, and *Planema poggei*.

[My friend Mr. Guy A. K. Marshall has kindly read through the proof-sheets of this paper, and has made many valuable suggestions.]

Explanation of Plate XVII.

The offspring of a *trophonius* form of *Papilio dardanus*, sub-sp. *cenea*, observed laying eggs on May 4, 1904, at Bellair, five miles from Durban, Natal. The observation was made and the eggs collected by Mr. G. F. Leigh, but the female parent escaped. The figures represent eleven out of the thirteen offspring bred by Mr. Leigh from these eggs at Durban. The specimens are in the Hope Department, Oxford University Museum.

All the figures are about $\frac{2}{3}$ of the natural size.

Fig. 1. Male offspring: pupated July 4, 1904; emerged August 5. The 10th to emerge. In this specimen the submarginal black band of the hind-wing is the least developed. There is however a slight trace of a narrow "sickle" partially closing the costal gap.

2. Male offspring: pupated June 26, 1904; emerged July 31. The 8th to emerge. The costal gap closed by a narrow "sickle."

3. Male offspring: pupated June 14, 1904; emerged July 25. The 5th to emerge. Although the costal gap is open there are traces of a black mark partially closing the inner gap.

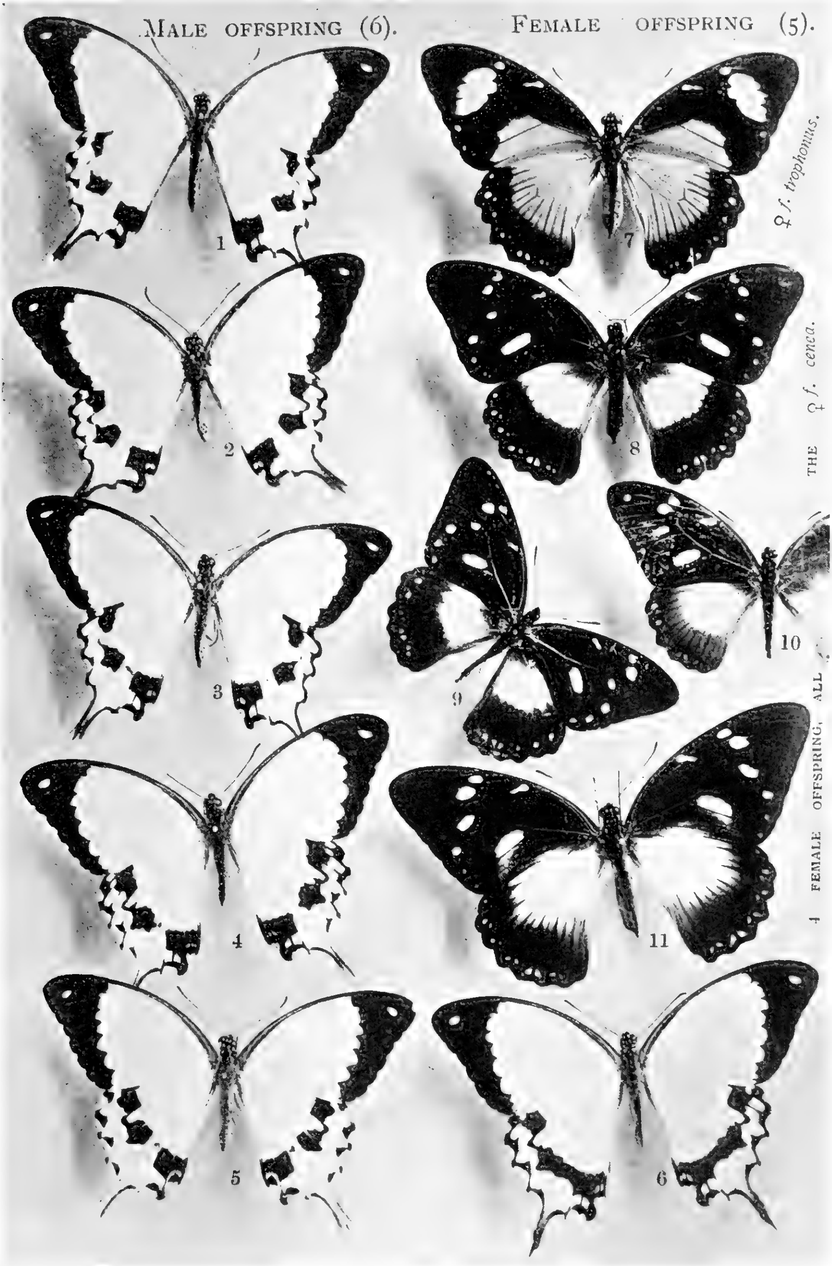
4. Male offspring: pupated June 12, 1904; emerged July 18. The 4th to emerge. Very similar to Fig. 3, but the costal gap is here completely closed.

In this figure and the two succeeding it is seen that the inner border of the black margin of the fore-wing is distinctly serrated, recalling the appearance of *meriones*.

5. Male offspring: pupated June 10, 1904; emerged July 5. The 2nd to emerge. Submarginal band of hind-wing slightly more developed, and the gaps slightly less than in Fig. 4.

The *meriones*-like serration described under Fig. 4 here reaches its maximum development.

6. Male offspring: pupated June 16, 1904; emerged July 27. The 6th to emerge. Hind-wing far more heavily marked than in any other of the male offspring, both gaps being completely closed. These males, emerging in July and August 1904, are as a whole far less heavily marked than those bred in November 1902 and November 1903, by Mr. G. F. Leigh.



Alfred Robinson, phot

Andre & Sleigh, Ltd.

All figures are about ⅔ of the natural size.

Forms of *Papilio dardanus*, sub. sp. *cenea*, bred in 1904 from a *trophonius* form of female. Durban, Natal.

Alfred Robinson, phot.

Andre & Sleigh, Ltd.

All figures are about the natural size.

Three female forms (1 3) of *Papilio dardanus* from the Kikuyu Escarpment, B.E. Africa,— *trimeni* (1) with primitive pattern, colouring, and rudimentary "tails" being ancestral to the other two. A *planemoides* ♀ form (4) from near Entebbe, gynandromorphic on left side.

FIG. 7. Female offspring, *trophonius* form : pupated July 6, 1904 ; emerged August 26. The 13th to emerge. A typical example of the southern form of *trophonius*, here for the first time bred from a *trophonius* female parent.

8. Female offspring, *cenea* form : pupated June 12, 1904 ; emerged July 17. The 3rd to emerge. The discal patch on the hind-wing is distinctly browner than usual,—a result of *trophonius* parentage appearing in an otherwise typical *cenea* ♀ form.

9. Female offspring, *cenea* form : pupated June 22, 1904 ; emerged July 29. The 7th to emerge.

10. Female offspring, *cenea* form : pupated July 8, 1904 ; emerged August 24. The 11th to emerge. The right-hand wings, being somewhat crippled, are only partially shown in the figure.

11. Female offspring, *cenea* form : pupated June 11, 1904 ; emerged July 4. The 1st to emerge. The shape of the principal spot of the fore-wing, and the development of a light patch on its inner margin, as well as the evident tendency of the two markings to fuse, show a distinct influence of the *trophonius* parentage.

EXPLANATION OF PLATE XVIII.

Female forms of *Papilio dardanus.*

All the figures are about the natural size. The butterflies were intended to be precisely of the natural size, but as a matter of fact they are all slightly enlarged. Furthermore, probably in consequence of the concurrence of minute errors, the figures on the right side, 3 and 4, are rather more magnified than those on the left, 1 and 2. The error is well within the limits of individual variation.

FIG. 1. *Papilio dardanus*, sub-sp. *polytrophus*, ♀ f. *trimeni*, n. f. Kikuyu Escarpment, British East Africa, 6500–9000 feet. W. Doherty, October—November 1900 : in the Hope Department, Oxford University Museum. The specimen shows distinct rudimentary "tails" to the hind-wing. The pale tints are yellow and not white, while the pattern is also very ancestral as compared with the *hippocoon* form from the same locality (Fig. 2).

Fig. 2. *Papilio dardanus*, sub-sp. *polytrophus*, ♀ f. *hippocoon*: data as in Fig. 1, except that the specimen was captured September—October 1900. Although far more specialized by mimicry of the black and white *Amauris niavius*, form *dominicanus*, the origin of the pattern from that of the *trimeni* form (Fig. 1) is clear and simple. It is accompanied by a change of the pale markings from yellow to white.

3. *Papilio dardanus*, sub-sp. *polytrophus*, ♀ f. *cenea*: data as in Fig. 2. This form is far more specialized, viz. further from the ancestral pattern still borne by the male insect (Plate XVII, Figs. 1–6), than the *hippocoon* (Fig. 2). At the same time it is by no means difficult to trace the independent origin of the *cenea* from the *trimeni* form by the spreading of the black ground colour.

4. *Papilio dardanus*, sub-sp. *merope*, ♀ f. *planemoides*, partially gynandromorphic on the left side. The male influence is not only seen in the conspicuous patches and streaks of pale yellow scales on both fore- and hind-wing, but also in the traces of the three submarginal black patches on the hind-wing (compare Plate XVII, Fig. 1). These are inconspicuous because placed on a dark ground; but they can be at once recognized by comparing the left with the right hind-wing which exhibits no trace of gynandromorphism. The pale markings on the right fore-wing were caused by accidental injury and are in no way comparable with the appearance on the left side due to the existence of yellow scales like those of the male. This interesting specimen was collected by Mr. T. T. Behrens, R.E., in Buddu, on the west shore of Lake Victoria, Nyanza, between Entebbe and the mouth of the Kageru River: December 3, 1902—March 1, 1903.

Explanation of Plate XIX.

Ancestral females of *Papilio dardanus*.

All the figures are about $\frac{9}{10}$ of the natural size.

Fig. 1. *Papilio dardanus*, sub-sp. *tibullus*, ♀ f. *trimeni*, n. f.

Zanzibar, Lieut. Turner, 1884: in the Hope Department, Oxford University Museum.

In this highly ancestral form of female the colour of the central part of the wings is not so white as in the *hippocoon* form, but very pale buff and thus far nearer to the colour of the male. The subapical patch is also imperfectly divided from the main pale patch of the fore-wing.

2. *Papilio dardanus*, sub-sp. *merope*, ♀ f. *hippocoon*.

Gaboon, Hewitson Coll., in Brit. Mus.

The exceptional variety of the *hippocoon* form here figured exhibits distinct rudiments of "tails" to the hind-wings. It is of much interest that this ancestral character should be associated with the ancestral pattern of the *hippocoon* form.

3. *Papilio dardanus*, sub-sp. *merope*, ♀ f. *hippocoon*.

W. Africa, Crowley Coll., in Brit. Mus.

This specimen of *hippocoon* also exhibits traces of the lost 'tails,' although to a much less extent than in the last figured specimen.

Explanation of Plate XX.

Planemoides females of *Papilio dardanus* together with intermediates between this and the other female forms.

All figures are about $\frac{7}{8}$ of the natural size.

Fig. 1. *Papilio dardanus*, sub-sp. *merope*, ♀ form intermediate between *cenea* and *planemoides*. In coll. A. H. Harrison, from Unyori, N.E. of Kisumu, about 1903. The specimen figured is beautifully intermediate between these two ♀ forms, of which the *planemoides* is seen in Figs. 2 and 4 and the *cenea* in Plate XVIII, Fig. 3. The discal patch of the hind-wing of this intermediate variety is not white as in *planemoides*. It is much nearer to the buff of *cenea*, but exhibits a faint reddish tinge which may indicate some influence of *trophonius*. Taken alone the specimen here represented would strongly suggest the origin of *planemoides* from *cenea*.

2. *Papilio dardanus*, sub-sp. *merope*, ♀ f. *planemoides*. Nyangori (Forest land), N.E. of Lake Victoria Nyanza, near Kisumu, 5000 feet. Captured November 1–8, 1902, by C. A. Wiggins. In Hope Department, Oxford University Museum. In everything except a curious overspreading of the discal patch of the hind-wings by dark scales this is a typical *planemoides* form.

3. *Papilio dardanus*, sub-sp. *merope*, ♀ f. *planemoides*, tending somewhat in the direction of *hippocoon*. From the same locality as Fig. 2. Collected about 1903 by A. H. Harrison. In Hope Department, Oxford University Museum. The *hippocoon* influence is seen in the great extension of the fulvous area along the inner margin of the fore-wing. This specimen taken alone suggests the origin of *planemoides* from *hippocoon* or *trimeni*. Compare Figs. 2 and 4 with 3.

4. *Papilio dardanus*, sub-sp. *merope*, ♀ f. *planemoides*. Nairobi, British East Africa, May 17, 1903. In coll. A. H. Harrison. The specimen figured is a fine typical example of this beautiful form. The extended basal black area of the hind-wing is an approach towards the much greater development of this marking in the model, *Planema poggei*.

Alfred Robinson, phot. Andre & Sleigh, Ltd.

All figures are about $\frac{9}{10}$ of the natural size

Ancestral females of *Papilio dardanus*,—the pattern and pale yellowish colouring characteristic of *trimeni* (1), and the rudimentary "tails" of these exceptional examples of *hippocoon* (2,3).

Alfred Robinson, phot.

Andre & Sleigh, Ltd.

All figures are about ¾ of the natural size.

The *planemoides* ♀ f. of *Papilio dardanus* (2, 4), with intermediate between *planemoides* and *cenea* (1), and between *planemoides* and *hippocoon* (3).

Explanation of Plate XXI.

Forms of *Acræa johnstoni,* together with their *Danaine* and *Acræine* models, from the slopes of Kilimanjaro, 1905.

The whole of the specimens figured, models as well as mimics, were presented to the Hope Department by Rev. K. St. Aubyn Rogers.

All the figures are about $\frac{9}{10}$ of the natural size.

Fig. 1. *Amauris echeria*, Boisd., ♂. The three largest spots of fore-wing and submarginal spots of hind-wing are buff-coloured: the submarginal and costal spots of fore-wing much paler buff, almost white. December 15–31, 1905: native collector.

1*a*. *Acræa johnstoni*, form *fallax*, Rogenh. (= *kilimandjara* Oberth.), ♂. *Fallax* differs from the *flavescens* (Fig. 1*b*) and *proteina* (Plate XXII, 1*a*, 1*b*) forms mainly in the broader, rounder apex of the fore-wing, the rounded instead of the squarish discal patch of hind-wing, and in the sexual dimorphism,—the males of *fallax* (Plate XXI, 1*a*) having buff spots in the fore-wing, the females (Fig. 2*a*) white. Furthermore the rounded discal patch of the hind-wing is here well seen to be indistinctly defined owing to the invasion of dark internervular rays, while the squarish patch of *flavescens* and *proteina* is sharply outlined. Intermediate forms occur, and there can be little doubt that Aurivillius is right in suggesting that *fallax* is a form of *johnstoni.*

The male of *fallax* with buff-spots in the fore-wing is seen to be an excellent mimic of the buff-spotted forms of *Amauris* such as that represented in Fig. 1.

The specimen shown in Fig. 1*a* was captured December 15–31, 1905, by a native collector.

1*b*. *Acræa johnstoni*, form *flavescens*, Oberth. The individual represented possesses very pale buff spots in the fore-wing, much paler than those of the male *fallax* (Fig. 1*a*). Specimens of *flavescens* however often possess spots of a pronounced shade. The individual shown in Fig. 1*b* is a mimic of *Amauris echeria* (Fig. 1), but as regards the pale spots is transitional towards the mimics of

Amauris albimaculata (Fig. 2), viz. the white-spotted *proteina* forms (Plate XXII, Figs. 1*a*, 1*b*), and towards the female of *fallax* represented in the next figure.

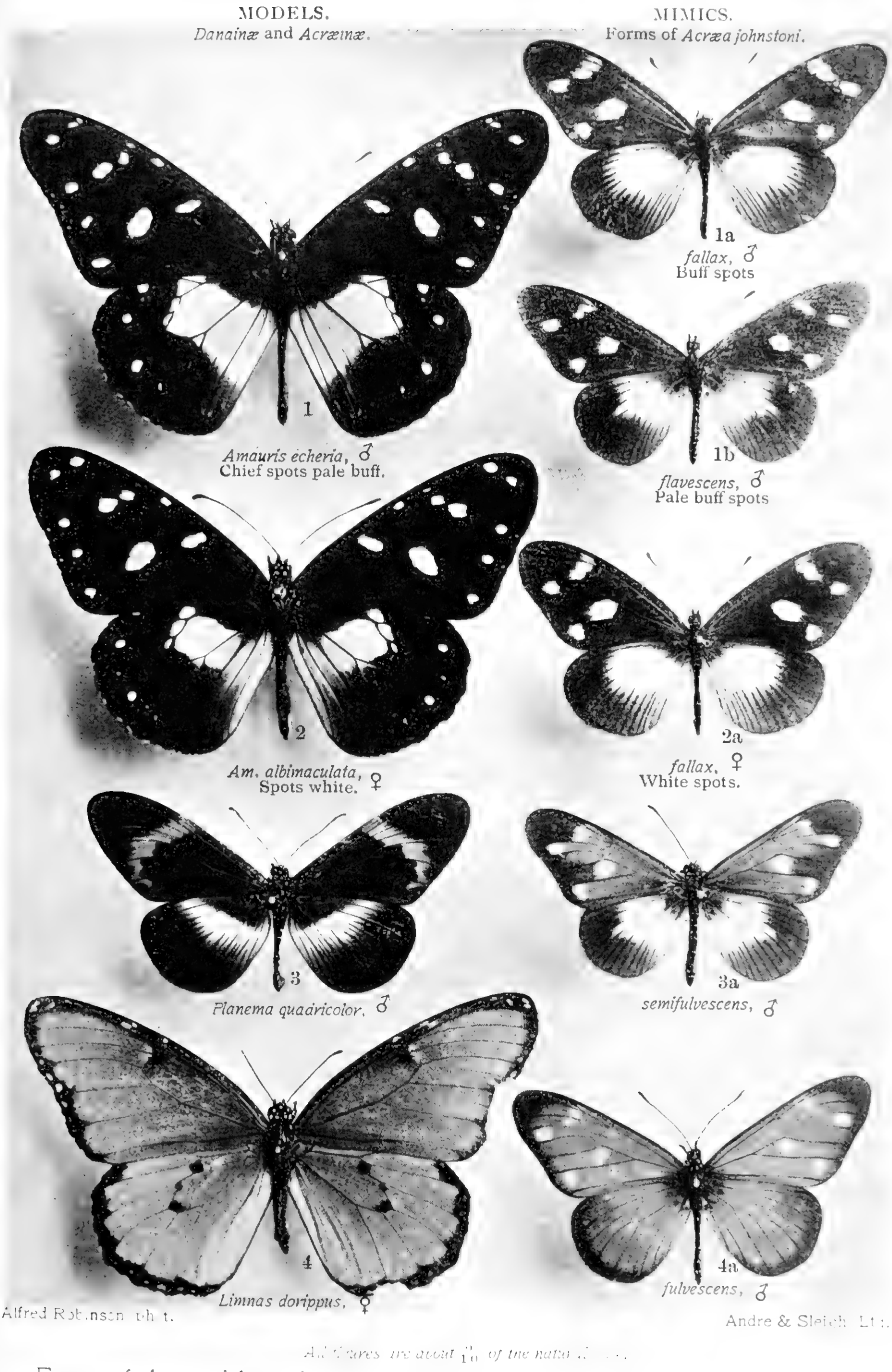
The hind-wing of *flavescens* (Fig. 1*b*) is seen to present a far more perfect resemblance to the Danaine models (Fig. 1, 2) than that of *fallax* (Figs. 1*a*, 2*a*). The superiority is brought about by a characteristically squarish buff discal patch which is sharply outlined and exhibits hardly any invasion of marginal rays. December 15–31, 1905 : native collector.

FIG. 2. *Amauris albimaculata*, Butl., ♀. In this specimen all the spots of both wings are pure white, the only buff marking being the discal patch of the hind-wing. December 15–31, 1905 : native collector.

2*a*. *Acræa johnstoni*, form *fallax*, Rogenh., ♀. The white-spotted female of this form is beautifully mimetic of the Danaine shown in Fig. 2. The discal patch of the hind-wing is however very similar to that of the buff-spotted male represented in Fig. 1*a* and like it less markedly mimetic than either the *flavescens* (Fig. 1*b*) or *proteina* (Plate XXII, Figs. 1*a*, 1*b*) forms. December 15–31, 1905 : native collector.

3. *Planema quadricolor*, Rogenh., ♂, the model of the *semifulvescens*, Oberth., form of *Acræa johnstoni* shown in Fig. 3*a*. The basal area of the hind-wing and the inner half of the fore-wing,—viz., the whole of its area on the basal side of the black-margined curved fulvous subapical band,—are of a deep rich brown hardly to be distinguished from black by photographic methods and therefore barely recognizable in the figure. N.E. slopes of Kilimanjaro, about 5000 feet; State of Mamba : September 25, 1905 : Rev. K. St. Aubyn Rogers.

3*a*. *Acræa johnstoni*, form *semifulvescens*, Oberth., ♂. The four characteristic spots, pale yellow in tint, lie on the borders of the fulvous inner area of the fore-wing; thus suggesting a likeness to the model (Fig. 3), where the inner area is also separated by a subapical bar of lighter tint from the black apical region. The pale yellowish discal patch of the hind-wing of course forms an area much broader than that of the model. In another specimen of this form however (Kilimanjaro, December 15–31, 1905, native collector) the basal half of this patch is almost obliterated by suffusion with ground colour, producing a much closer approximation to the hind-wing pattern of



Alfred Robinson phot.

Andre & Sleigh Ltd.

All figures are about [illegible] of the natural [illegible]

Forms of *Acræa johnstoni*, together with their Danaine (*Amauris*, *Limnas*) and Acræine (*Planema*) models, from the slopes of Kilimanjaro, 1905

the model. The specimen is unfortunately in too poor a condition for figuring.

Locality of specimen represented in Fig. 3*a*., N.E. slopes, Mamba State, about 5000 feet, September 26, 1905: Rev. K. St. Aubyn Rogers. It will be observed that the mimic was captured the day after that on which its model was taken.

FIG. 4. *Limnas chrysippus*, L., form *dorippus*, Klug. (= *klugii*, Butl.), ♀. This is the dominant form of *chrysippus* in British East Africa. Kilimanjaro, May 1905.

4*a*. *Acræa johnstoni*, form *fulvescens*, Oberth., ♂. An obvious and beautiful mimic of *dorippus* (Fig. 4). The ancestral markings persist, faint but distinct; and characteristic in shape and position on both wings. On the under-side they are more conspicuous. The basal spots on the hind-wing under-side are distinct, but the most prominent are in this form brown instead of black, and therefore comparatively inconspicuous. December 15–31, 1905: native collector.

EXPLANATION OF PLATE XXII.

Forms of *Acræa johnstoni* together with their Danaine and Acræine models.

All the figures are of the natural size.

FIG. 1. *Amauris lobengula*, E. M. Sharpe, ♂, from the forest, Mt. Chirinda (about 3600 feet). Melsetter, Gazaland, S.E. Rhodesia. Captured October 7, 1905, by Guy A. K. Marshall. The model of Figs. 1*a* and 1*b*.

1*a*. *Acræa johnstoni*, Godm., form *proteina*, Oberth., ♂. From the same locality as the last, and captured by Mr. Marshall on the same day. The relatively large size of the squarish discal patch of the hind-wing (compare Fig. 1*b* on Plate XXI) is an evident synaposematic approach towards the *Amauris* represented in Fig. 1, also characterized by an especially large discal patch.

FIG. 1*b*. *Acræa johnstoni*, form *proteina*, ♀, from the same locality as 1 and 1*a*. Captured by Mr. Marshall, October 11, 1905. The female exhibits a patch even larger than that of the male, and of a shape which approximates more closely to the model shown in Fig. 1.

2. *Planema poggei*, Dew., ♂, from Buddu, between Entebbe and the mouth of the Kageru River, west shore of Lake Victoria Nyanza; collected December 3, 1902—March 1, 1903, by T. T. Behrens, R.E. This *Acræine* butterfly with its broad fulvous band crossing the fore-wing, and white band crossing the hind-wing is evidently the primary model of the particular variety of the *semifulvescens*, Oberth., form of *A. johnstoni*, shown in Fig. 2*a*.

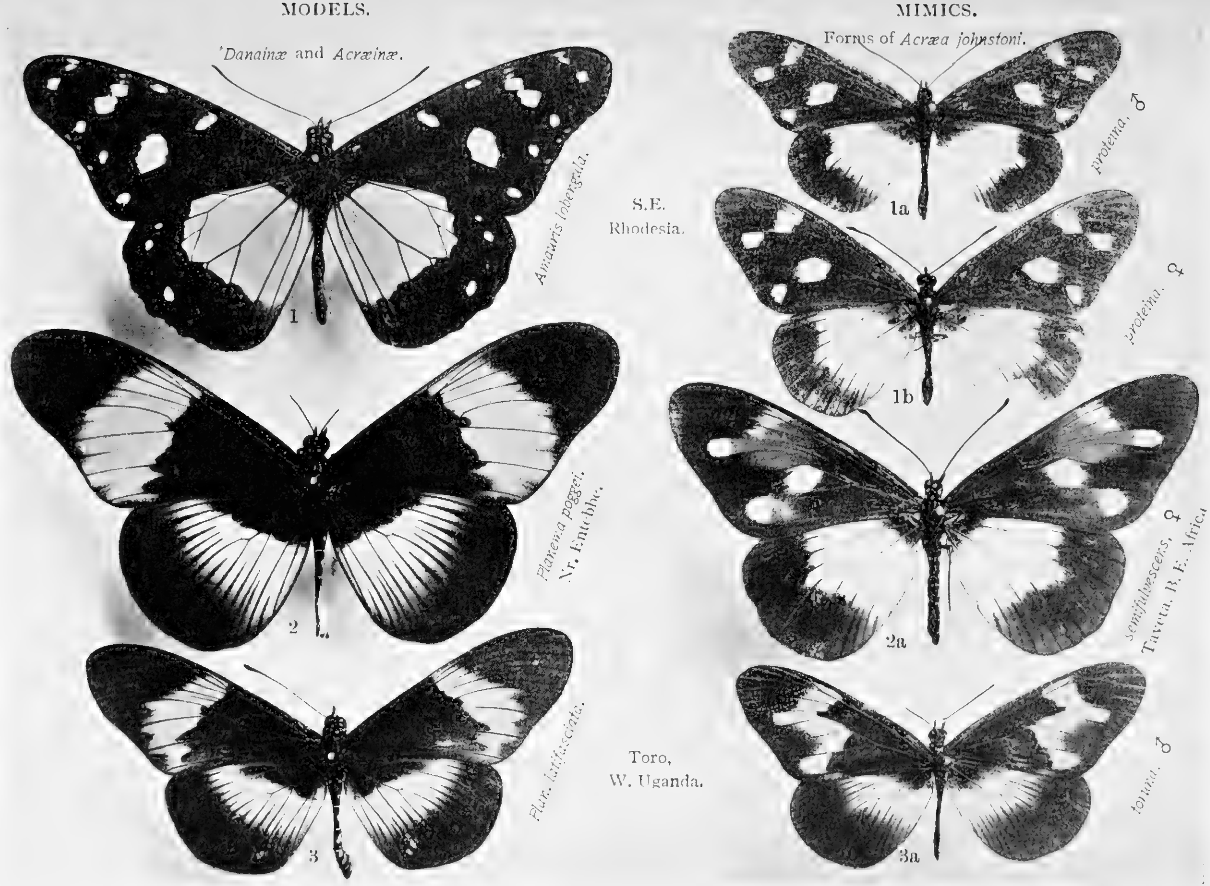
At the same time the latter exhibits a nearer approach to the *planemoides*, Trim., ♀ form of *Papilio dardanus*, Brown., one of its co-mimics (compare Plate XX, Fig. 4), than it bears to the central model of the group, *Planema poggei*.

2*a*. *Acræa johnstoni*, form *semifulvescens*, Oberth., ♀. From Taveta (about 2500 feet), British East Africa; May 15, 1905, Rev. K. St. Aubyn Rogers. This form possesses a pure white patch on the hind-wings, while the inner area of the fore-wings is black instead of fulvous as in typical *semifulvescens* (Plate XXI, Fig. 3*a*). This form appears to mimic the *planemoides* female of *Papilio dardanus* more closely than any other member of the large group clustered round *Planema poggei* (compare Plate X of the present volume, accompanying Mr. S. A. Neave's memoir).

3. *Planema latifasciata*, E. M. Sharpe, ♂; from Toro, W. Uganda (7–9000 ft.). November—December 1900: Major Rattray. This *Planema* is the model for the *toruna* form of *johnstoni* represented in the next figure.

3*a*. *Acræa johnstoni*, form *toruna*, H. Grose-Smith, ♂; from the same locality and date as the preceding. The mimetic likeness is strong in the deep rich brown of the inner area of the fore-wings and basal region of hind-wings in model and mimic, in the fulvous subapical band crossing the fore-wing and discal band crossing the hind-wing, and finally in the dark ground colour external to these striking markings.

In all forms of *Acræa johnstoni* here represented (Figs. 1*a*, 1*b*, 2*a*, and 3*a*), the under-side exposed during prolonged rest, when most of the fore-wing is hidden by



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All figures are the natural size.

Forms of *Acræa johnstoni*, together with their Danaine (*Amauris*) and Acræine (*Planema*) models.

the hind, is not mimetic of the respective Danaine (Fig. 1) and Acræine (Figs. 2 and 3) models, but presents an appearance synaposematic with many Acræas of about the same size. During flight, on the other hand, and probably during brief rest, nearly the whole of the fore-wing under-side is revealed, and the effect is then such as to reinforce the mimetic resemblance of the upper-side.

SEPTEMBER 22nd, 1906.

XVII. *Notes on the dominant Müllerian group of Butterflies from the Potaro District of British Guiana.* By WILLIAM J. KAYE, F.E.S.

[Read October 3rd, 1906.]

PLATES XXIII—XXVII

AT the request of Prof. E. B. Poulton I have undertaken to give some account of the Bionomics of British Guiana insects, especially of the Lepidoptera. The long and interesting paper by Mr. G. A. K. Marshall in the Transactions for 1902 has also impressed one that perhaps similar notes from another continent, though in no sense so full and complete, might not only prove of interest but perhaps of value in clearing up some debatable points. For the most part deductions have been made in the present case from the accumulation of specimens and no such experiments as recorded by Mr. Marshall can be given. Dates and conditions of capture have been recorded, and in many instances I am able to give my own observations on the specimens in Nature. Furthermore my collector, Mr. C. B. Roberts, who has been the whole time on the same ground, is able to supply many facts which are of value. It is a little unfortunate that he is not a trained naturalist or his notes might have been much fuller and more complete. The specimens that he has captured are however taken all together so remarkable that the bare list of what has occurred in one particular forest-path, would probably be thought sufficiently interesting. Besides this particular district—a forest road stretching for 16 miles back from the Potaro river about 30 miles above its confluence with the Essequibo—I personally in March, April, May, and early June in 1901, collected in many other districts, but I propose to deal chiefly if not exclusively with the joint captures by Mr. C. B. Roberts and myself made on the Potaro road. The road is more or less a winding track varying from 12 to 15 or even 20 feet wide and is in places on sandy soil, in others gravel, and is crossed with "corduroy"* for a great part of its length, while a small part is built up with the natural gravel. On either side it

* "Corduroy" is the term employed for a road made similarly to a railway track, *i. e.* with the small trunks of trees split in half and laid close together with the flat side downwards.

is flanked throughout its entire length with heavy forest containing greenheart, wallaba, and mora, besides a vast number of other less known trees.

The forest itself is dark and gloomy and throughout the greater part of the year excessively damp owing to a superabundant rainfall. The character of the vegetation is always the same as even in the dry season the trees are never otherwise than a fresh green. It is not surprising therefore that practically the whole of the Lepidoptera, excepting of course the several species of *Morpho*, present a very uniform sombre tone of coloration. Even the very fine and brightly-coloured *Heliconius catharinæ*, *Heliconius astydamia* and *Heliconius egeria* do not strike one in their surroundings as particularly gaudy, and one is bound largely to admit the assertion of A. H. Thayer in his memoir in Trans. Ent. Soc. 1903, p. 553, that many species we call conspicuous are not really so in their surroundings. It must however have been quite impossible for Nature to have evolved such minutely close resemblance in unrelated groups without the aid of Müllerian mimicry. It is impossible to imagine that say an Erycinid butterfly *Esthemopsis sericina,* should have arrived at the identical colour and markings of a Syntomid moth *Agyrta micilia* purely and simply by the process of syncriptic selection. It is the minutest details in the coloration that dispel such a probability: moreover in certain cases, as Prof. E. B. Poulton has cited, I could definitely state that butterflies settled on most "unsuitable" flowers for their protection. A good example is found in the *Lycoræa,-Melinæa,-Heliconius* group that frequents the white flowers of the plant *Eupatorium macrophyllum.* This becomes a most valuable piece of evidence, as the species frequenting these flowers form one of the most extensive of all the groups that we are in the habit of calling Müllerian. Although this *Lycoræa,-Melinæa,-Heliconius,* etc., group is by far the largest and most dominant, there are many other groups in the region: in fact the vast majority of the individuals belong to one or other of a "coterie" of similarly coloured species. In the *Hesperidæ* there are one or two conspicuous examples of synaposematic coloration, and the *Erycinidæ* offer some examples, and it is only in the *Lycænidæ* that there appears to be an absence of it; this bears out exactly what Prof. Poulton said in the Trans. Ent. Soc. 1902, p. 500. It should however be

noted that the Lycænids here are all very uniformly of a blue shade of colour, and doubtless amongst themselves they offer protection in some sort of way.

By far the most numerous, conspicuous and characteristic group of butterflies is the large Ithomiine, Lycoreane, and Heliconine group. The number of individuals contained within this series, certainly more than equals all the other butterflies to be found in most of the months of the year and probably in every month. This group is composed of the following species in their respective Families and Subfamilies :—

Family NYMPHALIDÆ.

Subfamily *ITHOMIINÆ.*

Genus MELINÆA.

1. *Melinæa mneme,* Linn.
2. *Melinæa crameri,* God. and Salv.
3. *Melinæa egina,* Cram.
4. *Melinæa mnasias,* Hew.

Genus MECHANITIS.

1 *Mechanitis pannifera,* Butl.
2. *Mechanitis polymnia,* Linn.

Genus CERATINIA.

1. *Ceratinia philidas,* God. and Salv.
2. *Ceratinia euclea,** Godt.

Subfamily *HELICONINÆ.*

Genus HELICONIUS.

1. *Heliconius numata,* Cram.
2. *Heliconius vetustus,* Butl.
3. *Heliconius silvana,* Cram.
4. *Heliconius eucoma,*† Hüb.

Genus EUEIDES.

1. *Eueides nigrofulva,* Kaye.
2. *Eueides isabella,* Cram.
3. *Eueides vibilia,* Godt.

Subfamily *NYMPHALINÆ.*

Genus ERESIA.

1. *Eresia eunice.*‡

* The more transparent *Ceratinia* species, *C. barii* and *C. vallonia,* do not strictly belong to this association.

† ? ab. of *H. numata.* ‡ Accidentally omitted from text.

Family DANAIDÆ.

Subfamily *LYCOREANÆ.*

Genus Lycorea.

1. *Lycorea ceres,* Cram.
2. *Lycorea pasinuntia,* Cram.

Family ERYCINIDÆ.

Subfamily *LEMONIINÆ.*

Genus Stalachtis.

1. *Stalachtis calliope,* Linn.

Supplementary species belonging to the group but occurring in other localities and not yet detected from the Potaro :—

Family NYMPHALIDÆ.

Subfamily *ITHOMIINÆ.*

Tithorea harmonia, Cram. = *T. megara,* Doub. Hew. *nec.* Godt.

Subfamily *NYMPHALINÆ.*

Protogonius hippona, Fab. (true).

Family PIERIDÆ.

Dismorphia amphione.

Of all these there is no doubt whatever that the several species of *Melinæa* are the models to which all the other species are converging. *Melinæa mneme* at the present time occurs in prodigious numbers. From March to May and from September to December inclusive (these approximating to the two dry seasons), it is almost invariably to be found sitting upon the white flowers of *Eupatorium macrophyllum* wherever that plant is found growing. In much lesser numbers *Melinæa crameri* is to be found. *Melinæa egina* is rather more plentiful than *M. crameri,* yet a very long way from being as common as *M. mneme.* Of the fourth *Melinæa* there is little to be recorded ; it is a single straggler that was taken on March 17th, 1905, and is either *Melinæa mnasius* or a closely

allied undescribed species. There must be much speculation as to whether *M. mneme* or *M. crameri* commenced to draw the many other species to them in coloration and pattern. *Melinæa mneme* is a strong variant in both fore- and hind-wings while *M. crameri* is very constant above and only as a very rare aberration is a form found with the black of the hind-wing divided by the ground colour so as to form a band. On the under-side, however, there is considerably more variation. The latter species, owing to its comparative constancy, must be looked upon as older than *M. mneme,* a very variable and apparently unstable species. It is however certain that if *M. crameri* was first in the field, *M. mneme* must have entered soon after, for many of the associated species of other genera follow *M. mneme* to a greater extent than *M. crameri.*

In fact *M. mneme* must have been far more potent than *M. crameri,* and the strong variability must have been a great factor in drawing so many different species to the association. Of *M. egina* there is every reason to suppose that it became a fixed and well-defined species early in the history of the group, for we find only one other species closely following it, and that also is a usually very constant species, *Heliconius silvana.* It should here be mentioned however that two specimens of *Heliconius* have been caught, one in March 1905, the other without date, which appear to be aberrations of *H. silvana* with a distinct transverse black band to the hind-wing. These undoubtedly point to a not very distant genetic relationship with *Heliconius numata.*

Unquestionably the closest "pairs" are the *Melinæa* with *Heliconius* species. *Mechanitis* follows them very closely with *Lycorea* also. While *Eueides, Ceratinia* and *Stalachtis,* in the order named, diverge more and more from the protected pattern. The identical pattern and colour in some of the forms of *Heliconius numata* to *M. mneme* is remarkable, as in the Potaro district the *Heliconius* is apparently never abundant, rarely even really common. I have only 32 specimens, and this represents the whole take. The series is most remarkable for the very extensive variation, some having a narrowly barred hind-wing, others having almost the whole of the hind-wing black except for the costal portion. The *Lycoreas* are certainly more abundant, while the *Mechanitis* species, both *pannifera* and *polymnia,* occur in large numbers. Of

the *Eueides* species the new *E. nigrofulva* has turned up twenty-four times to the twice only of the usually common *E. isabella*. *Ceratinia philidas* is probably only just beginning to be influenced by the group generally, and comparatively few specimens have been taken, in fact one only from the district proper.

The following table will show at a glance the adherents to each *Melinæa*, though doubtless the stress is a very complicated one, and inclined to form a general uniform pattern in the long run, rather than four.

The numbers under each species show the numerical quantity, actual or estimated.

LYCOREA.	MELINÆA.	HELICONIUS.	MECHANITIS.	EUEIDES.	CERATINIA.	STALACHTIS.
ceres 30	*mneme* * 400	*numata* 33	*pannifera* 80	*nigrofulva* 24	*philidas* † 1	*calliope* 1
pasinuntia 40	*crameri* 40	*vetustus* 8	—	—	—	—
—	*egina* 70	*silvana* 4	—	—	—	—
—	*mnasius* 1	—	—	—	*euclea* † 50	—
—	* *mneme* {extreme banded} 400	*numata* {extreme banded} 4	*polymnia* 700	*isabella* 2	—	—
		eucoma 1		*vibilia* 1		

Some of the above large numbers are estimated only. A trained collector might have detected many more specimens of some of the apparently rare species.

The result of a single day's catch recorded by Professor E. B. Poulton, p. liv–lvi, Trans. Ent. Soc. 1903, fairly well upholds the proportion of the various species. Mr. Roberts has been collecting for me for over four years, and my own three months brings the period up to four and a half years, so it must now be tolerably certain that we know all the species of the group and approximately the proportion of each one to one another.

This is a matter of very great interest, and it shows how the *Ceratinia* may obtain protection doubly—(1) when fresh by conforming to the main group, and (2) when it is worn and of a different appearance by being then mistaken for one of another group of species, a group composed of species of *Napeogenes*, *Ceratinia* and *Sais*, etc.

Although *Melinæa mneme* is nearly always present when

* Collector stopped catching this species. He could doubtless have taken several thousand.

† See under *Ceratinia*, p. 421.

a collection of these brown and black insects is found on the *Eupatorium* flowers, it is not so invariably. On May 14th, 1901, I remember being disappointed (from the collector's point of view), in coming upon a bush where there were only *Mechanitis polymnia* and *Ceratinia euclea* (*C. philidas* and *C. bendis*) present. Such a case as this clearly shows the value it is to these members to have been brought into harmony with the colours of the dominant *Melinæa mneme.* As although these species are only commencing to conform to the main colouring of the model they are able even among themselves to alight on these flowers and be comparatively immune from danger. It would have been interesting had every specimen of *Melinæa mneme* been retained to see the accurate proportions of the different forms. I have actually kept 70 set specimens, and these are divided up as follows:—

Melinæa mneme.

Hind-wing distinctly banded	40 = 57 %	Upper-side and Under-side
Hind-wing obscurely banded	22 = 31½%	
Hind-wing with band obliterated	8 = 11½%	

Thus only 1 in 9 is heavily black, and this I have more than once verified to be the approximate percentage.

A further interesting phase of variation is the presence or absence of the red marks just before the yellow apical band on fore-wing. The specimens give these figures:—

	UPPER-SIDE.	UNDER-SIDE.
Fore-wing with large red spots or band before yellow apical band	12 = 17%	50 = 71%
Fore-wing with faint or greatly suffused spots	40 = 57%	20 = 29%
Fore-wing with red spots, band obliterated, or nearly so	18 = 26%	——

These comparative figures are of great interest, as although this species is so dominant in point of numbers, the influence it exerts with its dark forms is very small indeed compared with that of its banded forms. It therefore becomes tolerably clear that the allied *Melinæa,—crameri*—which, although not nearly such a common species, but has a very constant black pattern, must have acted very strongly to create the powerful darkening tendency in the hind-wing.

Melinæa crameri.

Of the 28 specimens retained of this species there are the following proportions with regard to the dark area in the hind-wing:—

	UPPER-SIDE.	UNDER-SIDE.
Hind-wing without a band . .	27 = 96 %	21 = 75 %
Hind-wing with a band . . .	1 = 4 %	7 = 25 %
	28	28

The single specimen that shows a band above only shows it very indistinctly, but the seven that show banding beneath have it well defined, three of them show it particularly well, yet on the upper-side it is hardly discernible. A specimen in the Hope Collection at Oxford shows a very distinct band on the upper-side and this came from the same locality and was caught on August 28th, 1903. Seven other specimens were captured on the same day, but all of these were unbanded. It should be noted that this presence of a band on the under-side only, while the upper-side shows no sign of it is particularly instructive and interesting as it shows that selection on the wing and selection at rest are two different factors; moreover, as it will be shown later, the under-side shows more general agreement in the various members of the group taken as a whole.

The proportions of the spotted to non-spotted, with reddish, before the yellow apical band is most striking, especially when compared with the same on the under-side.

	UPPER-SIDE.	UNDER-SIDE.
Fore-wing with distinct red marks before yellow apical band	1 = 5 %	15* = 54 %
Fore-wing with faint red marks	1 = 5 %	13 = 46 %
Fore-wing without any red marks	26 = 90 %	0 = —
	28	28

* These show the spots coalesced into a band.

It appears evident from the specimens that the banding of the hind-wing and the presence of the red marks before the apex of fore-wing go together. It is also significant that these specimens have been secured in one or other of the two dry seasons. My own specimen, with an indication of a band in the hind-wing, has also the red marks before apex and was taken on March 27th, 1905, the end of the short dry season. Professor E. B. Poulton's banded specimen has also red marks before apex and was taken on August 28th, 1903, the early part of the long dry season.

In view of the great interest attached to this species as to whether it is the centre of the association of the darkened hind-winged insects, it may be useful here to look at the range of the insect. From the limited material available it seems certainly to be most plentiful in British Guiana. It occurs in the Berbice district adjoining Surinam, and from the only two specimens seen from there one shows a tendency to banding above and strongly below, the other is normal, both have indications of red apical marks on upper-side and strongly developed beneath. Six specimens originally in the Godman and Salvin collection now at South Kensington are labelled Roraima. This must mean somewhere in the Roraima district and not the mountain itself, which is bare rock and out of the Forest region. None of these six are at all banded, either *above or below*, and only one shows any apical marks, and that is only weakly and on the underside. These six specimens are therefore interesting as suggesting a more extreme dark form away back in the interior of the country. A single specimen has the label "Bartica," a place 40 miles in from the mouth of the Essequibo, and I myself took it there, though only singly. The only locality outside of British Guiana that I have been able to discover is a specimen with a label "Colombia," which like the Roraima specimen is now in South Kensington, but originally in the Godman and Salvin collection. Were it not that all insects in the latter collection have been set up and labelled with the greatest care one would be inclined to discredit the locality. The specimen is a very interesting one. It is strongly banded below, and both above and below has exceptionally strong red apica marks.

Of the other two *Melinæa* species there is little variation to record. *Melinæa egina* is extremely constant on the

upper-side, but again on the under-side there is a most interesting minor piece of variation. It is that there are indications of the formation of a black patch in the centre of the wing by the presence of a long black streak between veins 6 and 7 extending inwards towards base of wing. From 32 specimens examined the following are the tabulated results:—

Under-side with black streak well developed	6 = 19 %
Under-side with black streak slightly developed	14 = 44 %
Under-side without black streak	12 = 37 %
	32

Thus no less than 63 % show some slight development towards the pattern of *Melinæa crameri* on the under-side.

The other *Melinæa, M. mnasias,* is only represented by a single specimen and is probably only a wanderer to the Potaro district, its home being further south on the Amazons. As a link with the *Ceratinias* it is extraordinarily close, and indeed when sitting with closed wings would be even passed over by a skilled collector, so alike is it to a large *Ceratinia euclea.*

Mechanitis pannifera.

This is a most variable species and is very common. The ♀ is apparently quite rare compared to the male as I find I have only three in a series of 56 examples. The likeness however of these females, and one in particular, to the darkest forms of *Melinæa mneme* is extraordinary, for not only is the pattern and marking so close but the greatly enlarged size give the insect a look much more in general like the *Melinæas* than the smaller and narrower *Mechanitis* species.

The 56 specimens divide up as follows:—

	UPPER-SIDE.	UNDER-SIDE.
Hind-wing with a well-defined band	6 = 10 %	18 = 32 %
Hind-wing with the band partly obscured	26 = 46 %	35 = 63 %
Hind-wing with the band wholly obscured	24 = 44 %	3 = 5 %
	56	56

It will be noticed there are only three examples exhibiting a wholly obscured band on the under-side. Two of these are of males and one a female. All three have the extreme dark upper-side as well. Those put in the "partly obscured" category are examples showing a great contraction of the fulvous band by an extension of the black inwards from the outer margin. It, again, in this species is evident that on the under-side a wholly black area is the exception and not the rule while on the upper-side nearly half (44 %) the individuals are of the extreme black form. Again, looked at from another point of view there are no less than 95 % showing some sort of banding on the under-side, while on the upper-side there are only 56 %, and of these only 10 % that are well banded.

Mechanitis polymnia.

This species, which in point of numbers comes next to *Melinæa mneme*, is here as elsewhere a very constant one. I have estimated that at least 700 specimens have passed through my hands and I have detected only one example that showed any tendency towards a darkening of the hind-wing. This individual, a female, was taken on March 14th, 1905. On the upper-side the whole of the ground colour is darker and in the hind-wing the central black band and the black marginal band are considerably extended so that at the anal angle and near vein 5 these just meet. On the under-side of the hind-wing there is an even greater amount of black scaling. The costal band is increased in width in addition to the central and marginal bands, while the latter join at several points and between veins 4 and 5 completely coalesce.

There is a specimen that shows a very distinct yellow apical streak just as in the previous species *M. pannifera* but which is quite normal in the size of the band of the hind-wing. It also exhibits an almost complete suppression of the black mark between veins 2 and 3 of the fore-wing, and this also is a much more common phase of variation in the previous species.

Ceratinia species.

There yet remain the *Ceratinia species*, which although not very conspicuously within the group nevertheless link up certain other species of *Napeogenes*, *Sais* and *Ceratinia.*

These all group themselves together in a remarkable way, but it is not proposed here to deal with all of them. The *Ceratinia* which above all others conforms to the main group is *Ceratinia philidas*, G. and S. Whether this is a good species or a form of another is open to question. It becomes a matter of importance when one wishes to make a statement of its abundance or otherwise and its distribution through the different months of the year. *C. philidas,* G. and S., is in all probability only an aberrational form of *C. ninonia*, Hüb., and this again links up with intermediates to *C. bendis*, G. and S., and *C. euclea*, Godt. The species should therefore be called *euclea*, and all the different forms are merely aberrations on the Potaro. But the forms doubtless become fixed and definite in different localities. Thus at Roraima the *philidas* form seems predominant, but in Trinidad typical *euclea* occurs alone. *C.* ab. *philidas* is much more frequent in the ♀ sex. The genitalia of *C. philidas* look hardly different to *C. ninonia*, the former only having a longer clasper, but the genitalia of *C. euclea* and *C. ninonia* are the same. The very transparent look of some *C. ninonia* males is unquestionably due to wear, the scales brushing off in the way that the Hemarine Hawk Moths do. *C. barii*, Bates, is, however, a good species, and is always to be distinguished. Of undoubted *C. philidas* only seven specimens have been secured, but only one on the Potaro.* None of these show anything very different from the type which has the black central band not joined at any point with the black marginal band. It is of interest to note that the type specimen came from the Sierra de Sta Martha in Colombia. Although hitherto the Potaro district has not produced any very extreme forms there is no reason to suppose that they don't exist, as at Omai lower down the Essequibo some much darker forms have occurred, and I have a specimen from there with a black streak in the cell of the hind-wing and which has a much heavier and wider black central band. But in the National Museum at S. Kensington are two remarkable specimens labelled "Roraima," which have the whole of the lower half of the hind-wing black as in the dark *Lycorea* species and in *Heliconius vetustus.* Further evidence from Roraima supports that adduced from the *Melinæa crameri* that probably there there is to be found a much darker association generally.

* The specimen mentioned on page 416.

Heliconidæ.

Having reviewed the whole of the *Ithomiinæ* of the group one turns to the *Heliconidæ.* The members of this family form much the closest mimics, and the varied series of *Heliconius numata* makes a remarkable "pair" in all its forms to the equally variable *Melinæa mneme.*

The association of all the *Heliconius* species within the group must be very ancient as there is never any great divergence from some one or other of the Melinæas. It is a remarkable fact that while there are many other differently coloured *Heliconius* species in the neighbourhood they are never (? absolute) found on the white blossoms of the Eupatorium.

Four species of *Heliconius* have occurred that belong to the group. It is possible that one of these, *H. eucoma*, is not distinct from *H. numata.* But it is just probable, if unlikely, that several of the supposed aberrations are really distinct. Thirty-three of what have been all called *H. numata* have occurred. These are tabulated as follows:—

HELICONINÆ—Genus *Heliconius.*

Heliconius numata.—Thirty-three specimens received in all.

	UPPER-SIDE.	UNDER-SIDE.
Hind-wing narrowly banded black	3* = 9 %	—
Hind-wing widely banded black	19 = 58 %	—
Hind-wing with band almost submerged with outer margin	9 = 27 %	—
Hind-wing with band totally submerged	2 = 6 %	—
	33	—

It will be seen that by far the largest percentage have the hind-wing very broadly (but very variably) black banded and that the extreme darkening is quite of rare occurrence, only 6 % having been seen from the Potaro District. It is interesting to note that not a single

* One of these may prove to be a distinct species, having a much narrower wing and a much broader yellow post-median band.

one of the forms shows signs of forming the rounded shape of the black patch conforming to that of *Melinæa crameri,* yet I have six *H. numata* from the Demerara River, and two or three from much lower down the Essequibo, viz. Rockstone and Bartica, which show this in a remarkable way. Two in particular show a great extension of the black inwards about the cell, a phase of variation unknown to me from the Potaro.

The other two species of *Heliconius,* viz. *H. vetustus* and *H. silvana,* have occurred quite sparingly, the latter especially so. *H. vetustus* is here a comparatively constant species, and in the eight specimens secured the black area in the hind-wing is never divided by the ground colour. The only variation of the black area is that in some individuals the black extends nearer the costa, basally giving the appearance of a rounded area, while in others the black area stops short by quite a horizontal line.

Heliconius vetustus.

The eight specimens divide up thus:—

Upper-side	Black area sharply cut off .	2 = 25 %
	Black area extended upwards	6 = 75 %
Under-side	Black area divided	2 = 25 %
	Black area undivided . . .	6 = 75 %

The latter with the rounded black area agree very closely with some of the *H. numata,* especially those (6 % only) in which the black is undivided by the ground colour. But in the case of those that are almost undivided the shape is the same giving an agreement of another 27 %, or 33 % in all of the *H. numata* with this more usual form of *H. vetustus.*

A study of the red sub-apical patches in the fore-wing gives the following interesting result:—

Upper-side of fore-wing	without	red markings	before apex	8 = 100 %
Upper-side ,,	with	,,	,,	0 =
				8

Under-side of fore-wing	without	red markings	before apex	7 = 88 %
Under-side ,,	with	,,	,,	1 = 12 %
				8

The solitary specimen with three red markings has them well developed. The specimen is a ♀, and has the more usual rounded black area to the hind-wing, and it was captured on July 19th, 1904—the height of the rainy season.

Heliconius silvana.—The four specimens of this species are of remarkable interest. Two of them bear the usual pattern of black marking on the hind-wing while two show the black area divided by the ground colour, one being a good intermediate. Not one of the four have the white marginal spots developed. The species undoubtedly shows the strong local influence of its relatives, and especially is this to be noted in the two specimens with a banded hind-wing, these conforming with the predominant forms of *Melinæa mneme* and *Heliconius numata.* These banded *H. silvana,* although rare, have been recorded elsewhere. There are two such specimens in the Hewitson collection at South Kensington. One labelled Upper Amazon, and another a much smaller specimen, but more completely banded, from Para. The species is evidently on one of the limits of its distribution or would surely be commoner, especially as elsewhere, such as at Para, it is a very common and plentiful insect.

Heliconius eucoma.—A single specimen was secured by Mr. C. B. Roberts in 1902. It differs in no way from the type, and is a mere accidental visitor, apparently to the Potaro region. The home of the species is on the Lower Amazon. The species readily fits in with the group through the more extremely banded forms of *Heliconius numata.*

HELICONINÆ, Genus *Eueides.*

Three species of *Eueides* have occurred, *Eueides isabella, Eueides vibilia,* and *Eueides nigrofulva.** The two former only singly and the last not uncommonly. It is curious that one of the single specimens (that of *E. isabella*) is a common species, while the only species that has occurred at all frequently was found to be an undescribed species. It is this new species that conforms to a considerable extent to the main group, while *E. isabella* (as far as can be ascertained from a single individual) is of the ordinary

* Vide Ent. 1906, p. 52. Three other species of *Eueides* have occurred belonging to another small family group, *E. lybia, E. aliphera,* and *E. unifasciatus* (?).

form and shows no special influence of the main group. *Eueides isabella*, it should be mentioned here as elsewhere, strongly retains the pattern of the abundant *Mechanitis polymnia*, and this association is probably so ancient that the two species have had time to become fixed and definite. Both these two latter insects occur over a very wide area, and small variations of climate and environment have apparently little or no effect.

Eueides nigrofulva.

Of this newly discovered species twenty-five individuals in all have been secured. No less than twenty-two have been females while but three males have been taken. This may indicate that the males and females have different habits, but it may be simply that the males and females emerging at different times and that when the males were out they were either overlooked for something else or perhaps not looked for at all. This latter explanation seems to be more plausible when one examines the under-sides of the specimens as remarked on later. The series of females shows considerable transition from a moderately heavy-banded hind-wing, tending to fuse with the dark outer margin, to a fairly narrowly-banded form with no trace of fusion.

Of the extreme dark form there are four examples, but in no case is the area between the central band and the dark outer margin uniformly black. The males, as will be seen by a reference to the specimen of the insect, have a very much less dark hind-wing, with the black band far more broken up into spots than is ever found in the female. This difference together with the absence of yellow bands to the fore-wing gives the male sex a very different general appearance above. On the under-side, however, except for size, these differences vanish and there is practically no variation in the whole series of either males or females. This is remarkable testimony to the efficacy of selection when the species is at rest. Not only do male and female closely resemble one another on the under-side, but they with closed wings have a remarkable similarity to the under-side of *Heliconius numata*, and particularly to the less dark individuals of that species. The series of white marginal spots to the hind-wing, the most interesting appearance of a yellow patch of scales beyond

the cell between veins 5 and 7, and three white apical spots on the fore-wing are alike found in both *H. numata* and *E. nigrofulva,* not to mention the general arrangement of bands and colours.

Eueides isabella and *Eueides vibilia.*

As already mentioned both of these species have occurred but only singly. *E. isabella* is a perfectly normal example. It is remarkable that on the under-side with the wings closed it is hardly to be distinguished from *E. nigrofulva* except for the smaller sub-apical yellow spots forming a band. The straw-coloured patch of scales between veins 5 and 7 is wanting, and points to a more recent association with the group or at least with *Heliconius numata.*

The example of *Eueides vibilia* is much more removed from the normal and illustrates how this species is assuming a darkened hind-wing above. The black scaling of the marginal band shows an extension inwards towards the cell, and this is quite a special development in this species. The sub-apical straw-coloured spots are smaller than in typical examples and follow the pattern *E. isabella.* It must be confessed that on the under-side this insect has little of the general appearance of the majority of the group. The strong rayed aspect of the hind-wind without any band gives the insect a much more distinct and different-looking appearance. But it cannot be overlooked that the dark suffusion of the hind-wing above is significant of the influence of the more pronounced black hind-winged species, and this like the *Protogonius* is probably a resultant of selection for this end made only on the wing.

FAMILY—*DANAIDÆ.*

Sub-family—*LYCOREANÆ.*

The two members of the family *Danaidæ* both offer remarkable instances of the influences of colour and pattern. The two species are *Lycorea pasinuntia* and *Lycorea ceres.* The former shows the influence of the darkening tendency in the hind-wing much less than the latter, and this is the more remarkable because in other

localities even as close as Venezuela and Trinidad *L. ceres* occurs, and never shows the deep black colour on the hind-wing, while *L. pasinuntia* has its home almost confined to Guiana and yet does not conform to the local influence to so great an extent nor in such a large proportion of the specimens. Both species occur chiefly in the long dry season which usually sets in at the end of August and lasts up to nearly the close of December, but odd specimens may be turned up at most times of the year, and I personally took several of each in May 1901, when the rainy season had begun in earnest a month previously.

As has already been seen with the Ithomiines the darkening of the hind-wing is far more pronounced on the upper-side, in fact on the under-side there is always a well defined area where the dark scales fail to obliterate the band. Tabulated, *Lycorea ceres* works out thus:—

Lycorea ceres.	UPPER-SIDE.	UNDER-SIDE.
Hind-wing distinctly banded	6 = 30 %	18 = 90 %
Hind-wing obscurely banded	12 = 60 %	2 = 10 %
Hind-wing band obliterated	2 = 10 %	0 = ——
	20	20

We thus find that on the upper-side the specimens with a wholly and partially obscured band number 70 %, while on the under-side they only number 10 %, while the banded forms claim no less than 90 %, an almost complete reversal of the one to the other.

That this species should vary so in regard to the colouring of the hind-wing is not to be surprised at, but it is very remarkable that the pattern of the fore-wing should remain so constant, as there is never any tendency to the form *atergatis*, such as is so frequently met with in Trinidad, nor is there any tendency to darkening of the fore-wing, such as is frequent in Peru, proving by the latter case that the species is in no need of adopting a more uniformly dark aspect, even though it is able under certain conditions to do so. The interest centring round *Lycorea ceres* must always be considerable. It is a species that occurs in one or other of its forms throughout nearly

the whole of Central and South America with Cuba and Haiti. It is true most of the forms are known as distinct species, but if we only could ascertain where the forms overlapped such as we know *atergatis* and *ceres* overlap in Trinidad, there could be no possible doubt that the species was continuous from Mexico to Southern Brazil and from Peru to Para, and that we should find the forms merging one into another. With such a species as this it should be possible to decide by experiment whether all different climates and different climatic conditions tend to produce different geographical races as we know them, or whether the action of mimicry by selection is sufficient to account for these changes. That such a species should adopt so many tones of colour cannot be, because the forest has such a varying aspect, and that the insect when on the wing is variously concealed. The species in several of its phases (? all) is extremely conspicuous in flight, and in Guiana at least it is very conspicuous at rest on the flowers of *Eupatorium macrophyllum.* This *Eupatorium* is a widely distributed and common plant, and it is quite likely that in other parts of the continent it is frequented by this same *Lycorea* under various guises.

Lycorea pasinuntia.

This species is certainly commoner than the previous but its variation is not so considerable. And with regard to the complete darkening of the area of the band in the hind-wing it is a comparatively rare feature.

The variation works out thus with 27 examples :—

Lycorea pasinuntia.	UPPER-SIDE.	UNDER-SIDE.
Hind-wing distinctly banded	18 = 66 %	25 = 93 %
Hind-wing obscurely banded *	6 = 22 %	2 = 7 %
Hind-wing band obliterated †	3 = 11 %	0 = ——
	27	27

* This is the extreme form, but it is not nearly so complete as in *L. ceres.*

† Under this class are placed all those that are not completely banded, but the average is not so great as with *L. ceres.*

Table showing comparative percentages of species exhibiting a large undivided black area on UNDER-SIDE and UPPER-SIDE of hind wing.

		UNDER-SIDE.	UPPER-SIDE.
ITHOMIINE NYMPHALIDÆ.	Melinæa.	*crameri* 75 % *mneme* 12 % *egina* — *mnasias* —	*crameri* 96 % *mneme* 12 % *egina* — *mnasias* —
	Mechanitis.	*pannifera* 5 % * *polymnia* —	*pannifera* 44 % *polymnia* —
	Ceratinia.	*philidas* — *euclea*	*philidas* — *euclea*
HELICONINÆ.	Heliconius.	*vetustus* 75 % *numata* 3 % *silvana* — *eucoma* —	*vetustus* 100 % *numata* 6 % *silvana* 50 % *eucoma* —
	Eueides.	*nigrofulva* — *isabella* — *vibilia* —	*nigrofulva* 8 % † *isabella* — *vibilia* —
LYCOREANE DANAIDÆ.	Lycorea.	*pasinuntia* 1 % * *ceres* —	*pasinuntia* 11 % *ceres* 10 %
ERYCINIDÆ.	Stalachtis.	*calliope* —	*calliope* —

* The extreme black form still shows slight indication of banding beneath.

† Still showing a trace of banding.

Tithorea harmonia, Protogonius hippona, and *Dismorphia amphione.* Of these three species that fit into the group but have not yet occurred on the Potaro it is highly probable that the *Tithorea harmonia* remains to be discovered. It has been taken at Aunai, a locality higher up the Essequibo. Two specimens at South Kensington bear Aunai labels, and it is remarkable that both of these show no trace of the darkening of the hind-wing but are of the extreme banded form. One of the specimens exhibits the characteristic red apical markings on the under-side while the other is wholly without them. It seems clear from the material available that Surinam and Cayenne produce the darkest forms of *T. harmonia*, while British Guiana gives the *megara* form which is banded. Cramer's figure of *harmonia* shows the insect on the under-side and gives the heavy black form with only the veins showing of the ground colour. It is however significant that in five specimens from Paramaribo at South Kensington only one shows an unbanded form on the under-side. In this latter form the *Tithorea* fits in much better with the group generally, as it has already been shown how frequently the black area is divided on the under-side even when complete on the upper-side.

Protogonius hippona fits in admirably with the group; many of the special characteristics being exceedingly well brought out. The only specimens that I know of and have seen of this species are one from Berbice and two from Cayenne. It is therefore possible that the insect belongs more strictly to the territory known as Dutch and French Guiana, Berbice being conterminous with Surinam although within the British area. The insect is chiefly remarkable in having besides the heavy blackening of the hind-wing a row of very conspicuous large white spots to the margin of the hind-wing, at once recalling the *Lycoreas, ceres* and *pasinuntia.* As with all the *Protogonius* species this one is doubly protected in having a cryptic under-side, while on the upper-side it gains protection by similitude to a protected group.

It cannot however here be insisted too strongly that the *Protogonius* proves most conclusively that when it is on the wing it must be the *upper-side* that is seen by its enemies, or else how could such a pattern be evolved independently of the very different pattern of the under-side?

Table showing members of the group that

	JANUARY.	FEBRUARY.	MARCH.	APRIL.	MAY.	JUNE.
ITHOMIINE NYMPHALIDÆ.	*M. mneme.*	*M. mneme.*	*M. mneme.*	*M. mnene.*	*M. mneme.*	*M. mneme.*
	M. crameri.	*M. crameri.*	*M. crameri.*	*M. crameri.*	*M. crameri.*	*M. crameri.*
	M. egina.	*M. egina.*	*M. egina.*	*M. egina.*	*M. egina.*	—
	—	—	*M. mnasius.*	—	—	—
	Mech. pannifera.	*M. pannifera.*	*M. pannifera.*	*M. pannifera.*	*M. pannifera.*	*M. pannifera.*
	M. polymnia.	*M. polymnia.*	*M. polymnia.*	*M. polymnia.*	*M. polymnia.*	*M. polymnia.*
	C. euclea.	*C. euclea.*	*C. euclea.*	*C. euclea.*	*C. euclea.*	*C. euclea.*
	—	—	—	—	*C. philidas.*	—
HELICONINÆ.	*Hel. vetustus.*	*H. vetustus.*	*H. vetustus.*	—	*H. vetustus.*	—
	H. numata.	*H. numata.*	*H. numata.*	*H. numata.*	*H. numata.*	—
	—	*H. silvana.*	*H. silvana.*	—	—	—
	—	—	—	*H. eucoma.*	—	—
	E. nigrofulva.	—	*E. nigrofulva.*	*E. nigrofulva.*	*E. nigrofulva.*	*E. nigrofulva.*
LYCOREANE DANAIDÆ.	—	—	—	—	*L. pasinuntia.*	—
	—	—	—	—	*L. ceres.*	—
ERYCINIDÆ.	—	—	*S. calliope.*	—	—	—

have occurred in each month of the year.

JULY.	AUGUST.	SEPTEMBER.	OCTOBER.	NOVEMBER.	DECEMBER.
M. mneme.	*M. mneme.*	*M. mneme.*	*M. mneme.*	*M. mneme.*	*M. mneme.*
M. crameri.	*M. crameri.*	*M. crameri.*	*M. crameri.*	*M. crameri.*	*M. crameri.*
—	*M. egina.*	—	—	*M. egina.*	*M. egina.*
—	—	—	—	—	—
M. pannifera.	*M. pannifera.*	*M. pannifera.*	*M. pannifera.*	*M. pannifera.*	*M. pannifera.*
M. polymnia.	*M. polymnia.*	*M. polymnia.*	*M. polymnia.*	*M. polymnia.*	*M. polymnia.*
C. euclea.	*C. euclea.*	—	—	—	—
—	—	—	—	—	—
—	*H. vetustus.*	—	—	*H. vetustus.*	*H. vetustus.*
H. numata.	—	—	—	*H. numata.*	*H. numata.*
—	—	—	—	—	—
—	—	—	—	—	—
—	*E. nigrofulva.*	—	—	*E. nigrofulva.*	*E. nigrofulva.*
—	*L. pasinuntia.*	—	*L. pasinuntia.*	*L. pasinuntia.*	*L. pasinuntia.*
—	*L. ceres.*	—	*L. ceres.*	*L. ceres.*	*L. ceres.*
—	—	—	—	—	—

In viewing the group as a whole what is most striking is that there is much closer agreement on the under-side than on the upper-side, and it is quite clear that selection must take place while the insects are resting with their wings folded. It should be convincing to the greatest sceptic that say the red apical marks on the under-side could never run through such a series if selection were made on the wing as is affirmed by all those who implicitly believe in the protective environment theory. What comes out clearly from these investigations is that only two species, *Melinæa crameri* and *Heliconius vetustus*, show a large proportion of specimens with a heavy black under-side. The tendency at the present time is all in favour of a banded under-side. On the upper-side the black development is far more pronounced as *Mechanitis pannifera* joins in with 50 % of its forms dark and *Lycorea ceres* with 40 %. Whatever however may be the real cause of these darkened hind-winged forms so characteristic of the Guiana region it is certain that the forces at work are now not so potent for their development as for the more barred forms. It however may be that the selection for the upper-side made upon the flying specimen is acting much more slowly than upon the sedentary individuals, and this at least seems plausible as it is beyond question that the members of this large group spend the greater part of their time at rest on flower-heads and become so engrossed, that they show no inclination to fly, a collector being able to catch individuals with his fingers as they sit feeding.

Explanation of Plates.

Plate XXIII.

Müllerian group of Ithomiine, Lycoreane, Heliconine, and Lemoniine butterflies, showing the darkest forms. The upper- and undersides of every specimen is shown.

All specimens are from the Potaro River, thirty miles above its confluence with the Essequibo, British Guiana. (Between the eighth and tenth mile from the Potaro, on the road to the gold mines.)

All figures are about $\frac{2}{3}$ of the natural size.

Fig. Ithomiinæ.

1. *Mechanitis pannifera*, ♂ : captured by C. B. Roberts, Aug. 28th, 1903 : in Hope Dep.
2. *Mechanitis pannifera*, ♀ : captured by C. B. Roberts, about Aug —Oct. 1901 : in Coll. Kaye.
3. *Mechanitis polymnia*, ♀ : captured by C. B. Roberts, March 14th, 1905 : in Coll. Kaye.
4. *Ceratinia philidas* : captured by W. J. Kaye, May 17th, 1901 : in Coll. Kaye.
5. *Melinæa egina* : captured by C. B. Roberts, Aug. 28th, 1903 : in Hope Dep.
6. *Melinæa crameri* : captured by C. B. Roberts, no date : in Coll. Kaye.
7. *Melinæa mneme* : captured by C. B. Roberts, Aug. 28th, 1903 : in Hope Dep.

The same specimen is represented in Fig. 7, Pl. XXVI.

Lycoreanæ.

8. *Lycorea ceres* : captured by C. B. Roberts, Nov.—Dec. 1901 : in Coll. Kaye.
9. *Lycorea pasinuntia* : captured by C. B. Roberts, no date : in Coll. Kaye.

Heliconinæ.

10. *Heliconius silvana* : captured by C. B. Roberts, March 5th, 1905: in Coll. Kaye.
11. *Heliconius vetustus* : captured by C. B. Roberts, March 18th, 1905 : in Coll. Kaye.

Fig.

12. *Heliconius numata*: captured by C. B. Roberts, April 2, 1905: in Coll. Kaye.

    The same specimen is represented in Fig. 14, Pl. XXVI.

13. *Eueides nigrofulva* ♂: captured by C. B. Roberts, Nov.—Dec. 1902: in Coll. Kaye.
14. *Eueides nigrofulva*, ♀: captured by C. B. Roberts, March 25th, 1905: in Coll. Kaye.

Lemoniinæ.

15. *Stalachtis calliope*: captured by C. B. Roberts, March 26th, 1905: in Coll. Kaye.

Plates XXIV (upper-sides) and XXV (under-sides).

Müllerian group of Ithomiine, Lycoreane, and Heliconine butterflies, showing the extreme banded forms.

The specimens represented are the same, and their figures occupy corresponding positions on both plates.

All specimens are from the Potaro River, and all, except those represented in 10 and 14, from thirty miles above its confluence with the Essequibo, British Guiana. (Between the eighth and tenth mile from the Potaro, on the road to the gold mines.) Specimens shown in Figs. 10 and 14 are from Tumatumari, fifteen miles lower down the Potaro river.

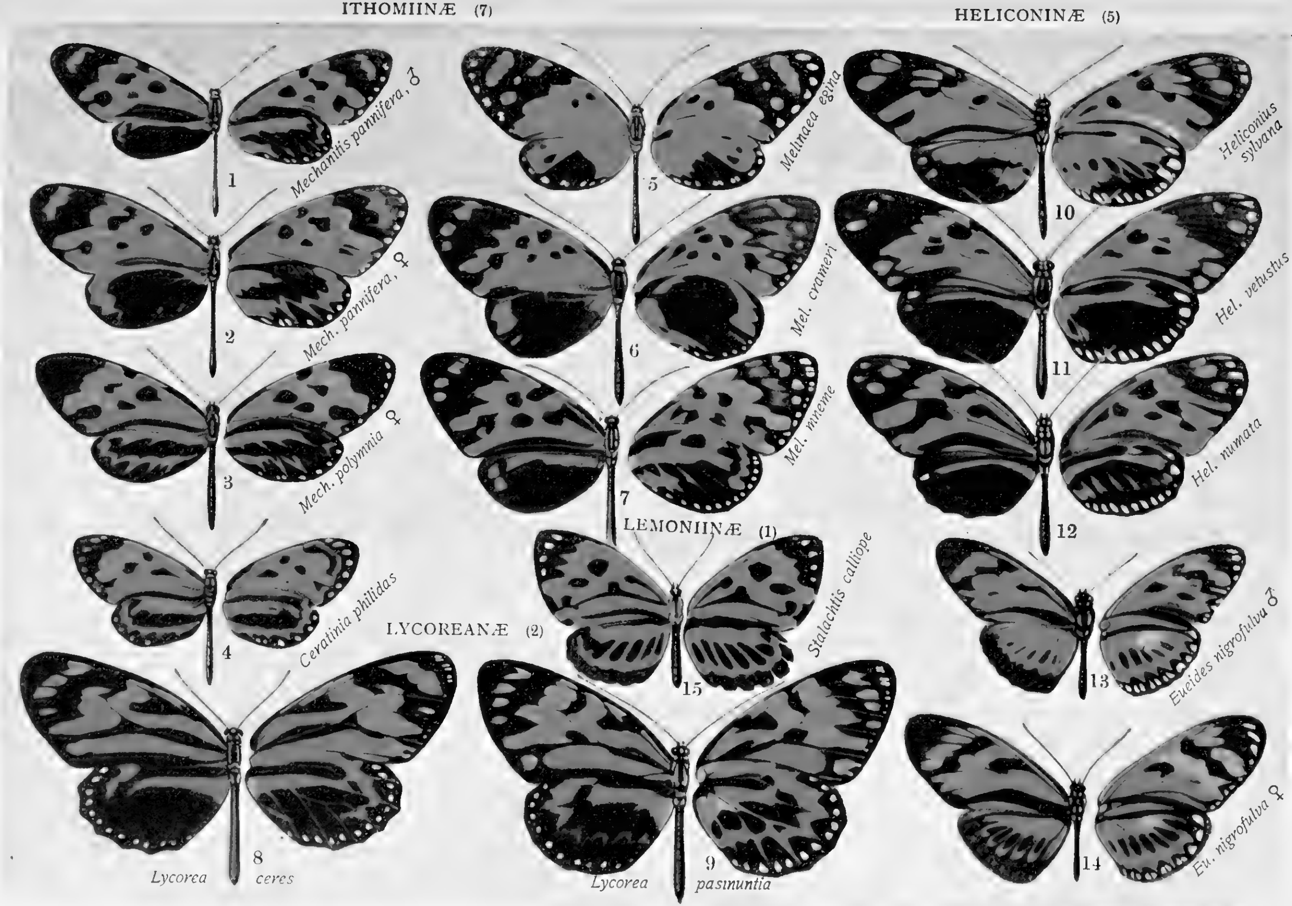
All figures are $\frac{2}{3}$ of the natural size.

Ithomiinæ.

1. *Mechanitis pannifera*, ♂: captured by C. B. Roberts, Sept. 1903: in Coll. Kaye.
2. *Mechanitis polymnia*, ♂: captured by C. B. Roberts, Nov.—Dec. 1901: in Coll. Kaye.
3. *Mechanitis polymnia*, ♀: captured by C. B. Roberts, Sept. 3rd, 1903: in Coll. Kaye.
4. *Ceratinia euclea* form *ninonia*: captured by Percival, April 3rd, 1904: in Coll. Kaye.
5. *Melinæa crameri*, ♂: captured by C. B. Roberts, Aug. 28th, 1903: in Hope Dep.
6. *Melinæa mneme*, ♂: captured by C. B. Roberts, August 28th, 1903: in Hope Dep.

   The same specimen is represented in Fig. 2, Pl. XXVI.

7. *Melinæa mnasius*: captured by C. B. Roberts, March 17th, 1905: in Coll. Kaye.

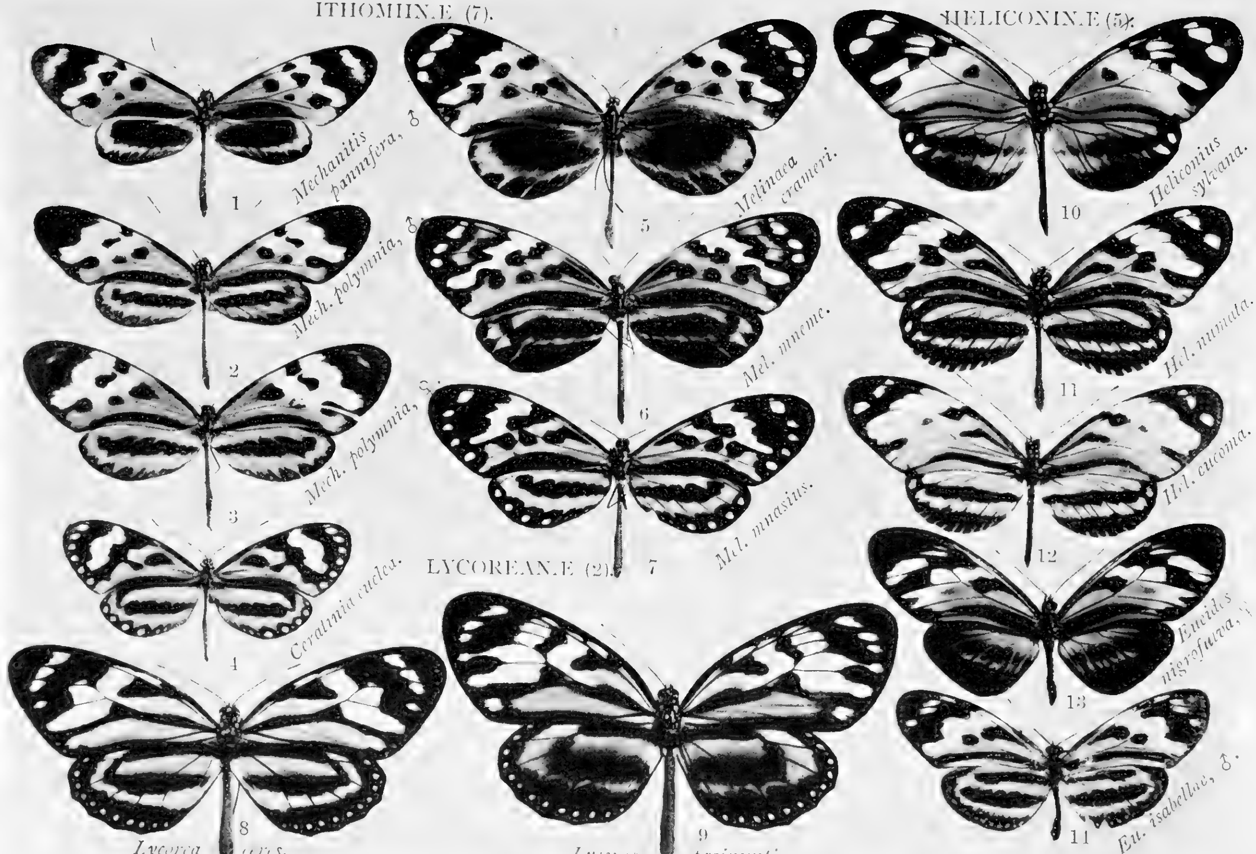


Horace Knight, pinx.

All figures are about ⅔ of the natural size.

Andre & Sleigh, Ltd.

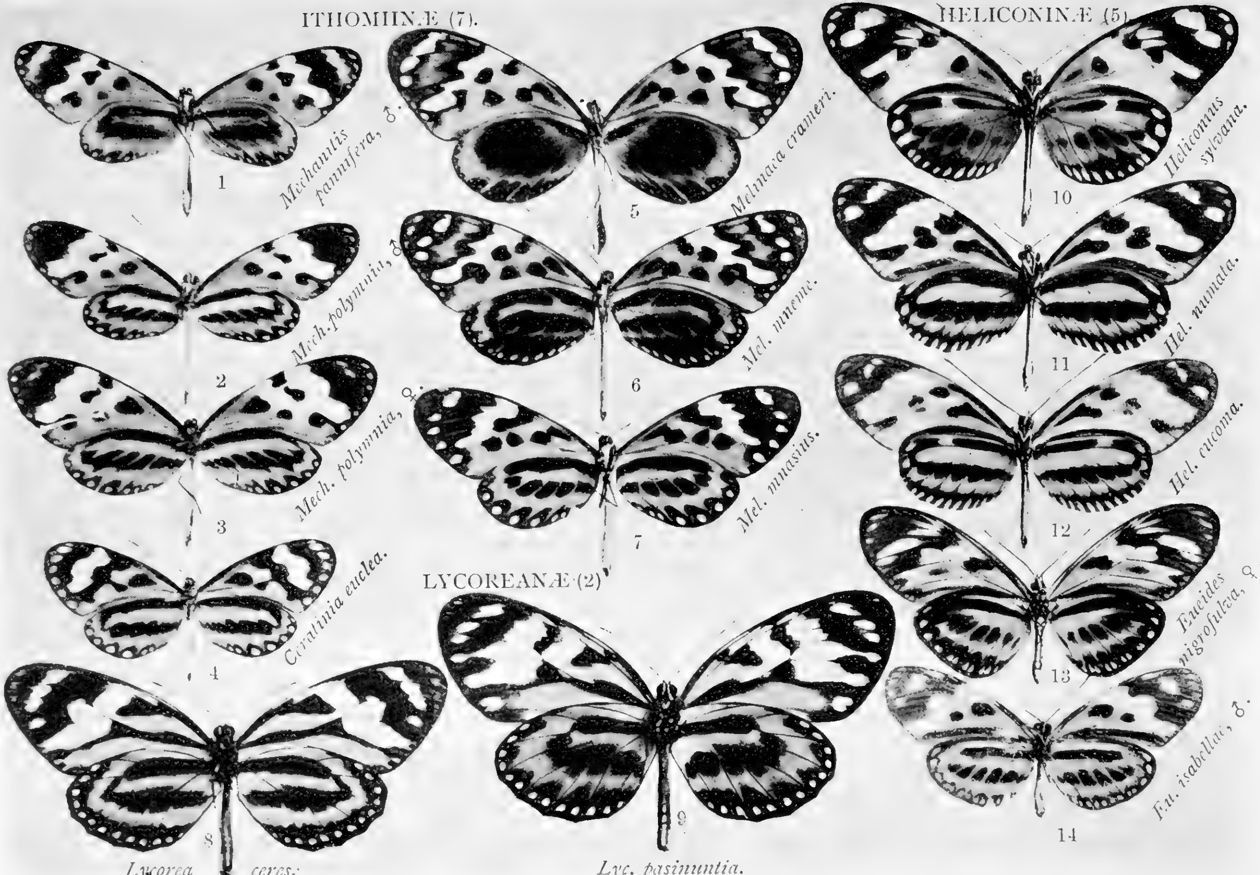
Müllerian (Synaposematic) Resemblance between Ithomiine, Lycoreane, Heliconine and Lemoniine Butterflies with dark hind wings; from the Potaro River, British Guiana. Upper and under surfaces shewn. Barred forms of nearly all the figured species are shewn on Plates XXIV. and XXV.



Alfred Robinson, phot. • All figures are natural size. Witherby & Co.

Mullerian (Synaposematic) Resemblance between Ithomiine, Lycoreane and Heliconine Butterflies, with barred hind wings; from the Potaro River, British Guiana.

The under surface of every specimen here represented is shewn in the corresponding figure of the following Plate.



All figures are $\frac{2}{3}$ of the natural size.

Alfred Robinson, phot. Witherby & Co.

Mullerian (Synaposematic) Resemblance between Ithomiine, Lycoreane and Heliconine Butterflies, with barred hind wings: from the Potaro River, British Guiana.

The upper surface of every specimen here represented is shewn in the corresponding figure of the preceding Plate.

FIG. LYCOREANÆ.

8. *Lycorea ceres*: captured by C. B. Roberts, probably Dec. 1901 or Jan. 1902: in Hope Dep.
9. *Lycorea pasinuntia*: captured by C. B. Roberts, Oct. 1901: in Hope Dep.

The same specimen is represented in Fig. 2, Pl. XXVII.

HELICONINÆ.

10. *Heliconius silvana* ab. *divisus*: captured, in 1904, by G. C. Cole at Tumatumari, Potaro River, fifteen miles above confluence with the Essequibo: in Coll. Kaye.
11. *Heliconius numata*: captured by C. B. Roberts, Feb. 10th, 1905: in Coll. Kaye.

The same specimen is represented in Fig. 8, Pl. XXVI.

12. *Heliconius eucoma*: captured by C. B. Roberts, about 1902: in Coll. Kaye.
13. *Eueides nigrofulva*, ♀: captured by C. B. Roberts, June 30th, 1902: in Coll. Kaye.
14. *Eueides isabella*: captured, in 1904, by G. C. Cole at Tumatumari (see Fig. 10): in Coll. Kaye.

PLATE XXVI.

Series of *Melinæa mneme* and *Heliconius numata*, showing parallel transition from barred to black hind-wings.

All specimens are from the Potaro River, thirty miles above its confluence with the Essequibo, British Guiana. (Between the eighth and tenth mile from the Potaro, on the road to the gold mines.)

All figures are $\frac{2}{3}$ of the natural size.

1 *Melinæa mneme*, ♂: captured by C. B. Roberts, Aug. 28th, 1903: in Hope Dep.

2. *Melinæa mneme*, ♂: captured by C. B. Roberts, Aug. 28th, 1903: in Hope Dep.

The same specimen is represented in Fig. 6, Pl. XXIV, XXV.

3. *Melinæa mneme*, ♂: captured by C. B. Roberts, Aug. 28th, 1903: in Hope Dep.
4. *Melinæa mneme*, ♂: captured by C. B. Roberts, Aug. 28th, 1903: in Hope Dep.
5. *Melinæa mneme*, ♂: captured by C. B. Roberts, Aug. 29th, 1903: in Hope Dep.

FIG.

6. *Melinæa mneme*, ♂ : captured by C. B. Roberts, Aug. 28th, 1903: in Hope Dep.
7. *Melinæa mneme*, ♂ : captured by C. B. Roberts, Aug. 28th, 1903 : in Hope Dep.

   The same specimen is represented in Fig. 11, Pl. XXIV, XXV.
8. *Heliconius numata* : captured by C. B. Roberts, Feb. 10th, 1905 : in Coll. Kaye.
9. *Heliconius numata* : captured by C. B. Roberts, March 3rd, 1905 : in Coll. Kaye.
10. *Heliconius numata* : captured by C. B. Roberts, March 4th, 1905: in Coll. Kaye.
11. *Heliconius numata*, captured by C. B. Roberts, Feb. 9th, 1905 : in Coll. Kaye.
12. *Heliconius numata* : captured by C. B. Roberts, March 4th, 1905 : in Coll. Kaye.
13. *Heliconius numata* : captured by C. B. Roberts, Dec. 9th, 1904 : in Coll Kaye.
14. *Heliconius numata* : captured by C. B. Roberts, April 2nd, 1905 :

   The same specimen is represented in Fig. 12, Pl. XXIII.

PLATE XXVII.

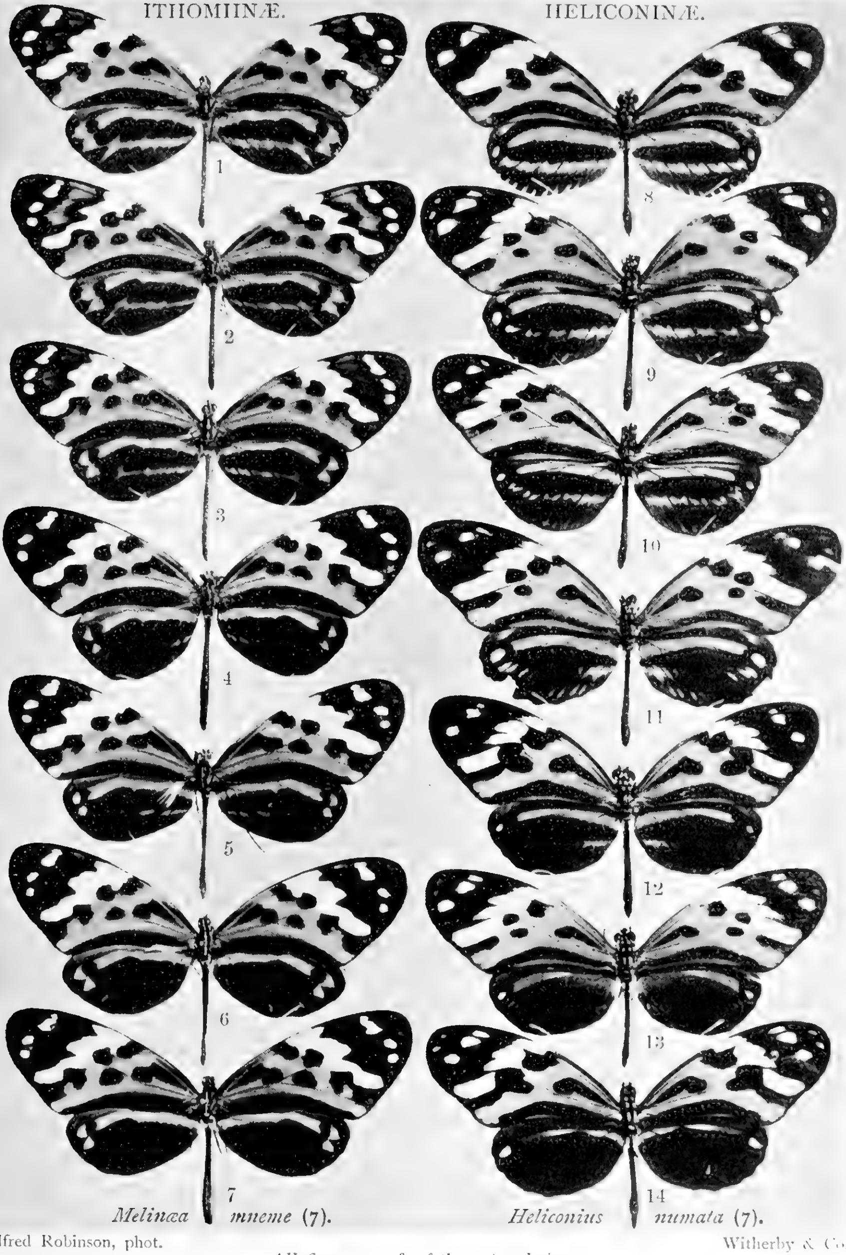
Series of *Lycorea pasinuntia* and *Lycorea ceres*, transition from barred to black hind-wing, showing parallel.

All specimens are from the Potaro River, thirty miles above its confluence with the Essequibo, British Guiana. (Between the eighth and tenth mile from the Potaro on the road to the gold mines.)

All figures are about $\frac{3}{5}$ of the natural size.

1. *Lycorea pasinuntia*, barred form : captured by C. B. Roberts, Oct. 1901 : in Coll. Kaye.
2. *Lycorea pasinuntia*, darkest barred form : captured by C. B. Roberts, Oct. 1901 : in Hope Dep.

   The same specimen is also figured in Plates XXIV and XXV, Fig. 9.
3. *Lycorea pasinuntia*, intermediate form : captured by C. B. Roberts, Nov.—Dec. 1901 : in Coll. Kaye.
4. *Lycorea pasinuntia*, dark form with faint traces of inner section of pale submarginal band : captured by C. B. Roberts, Nov.—Dec. 1901 : in Coll. Kaye.



Melinæa mneme (7). *Heliconius numata* (7).

Alfred Robinson, phot. Witherby & Co.

All figures are ⅔ of the natural size.

Parallel transition from barred to black hind wing in an Ithomiine butterfly and its Heliconine (Müllerian) Mimic; from the Potaro River, British Guiana.

Alfred Robinson, phot. Witherby & Co.

All figures are about ⅔ of the natural size.

Parallel Transition from barred to black hind wing in two Lycoreane butterflies; from the Potaro River, British Guiana.

FIG.

5. *Lycorea pasinuntia*, dark form with faint trace of inner end of pale submarginal band: captured by C. B. Roberts, Nov.—Dec. 1901: in Coll. Kaye.
6. *Lycorea pasinuntia*, darkest form: captured by C. B. Roberts in 1901: in Coll. Kaye.
7. *Lycorea ceres*, barred form: captured by C. B. Roberts, Nov.—Dec. 1901: in Coll. Kaye.
8. *Lycorea ceres*, darker barred form: captured by C. B. Roberts, Oct. 1901: in Coll. Kaye.
9. *Lycorea ceres*, median section of pale submarginal band has disappeared: captured by C. B. Roberts, 1901, probably Dec., or 1902, probably Jan.: in Hope Dep.
10. *Lycorea ceres*, more complete disappearance of median section of pale band: captured by C. B. Roberts, 1901, probably Dec., or 1902, probably Jan.: in Hope Dep.
11. *Lycorea ceres*, submarginal bar as in last figure; the pale discal bar is however far more reduced in the specimen here represented: captured by C. B. Roberts, 1901, probably Dec., or 1902, probably Jan.: in Hope Dep.
12. *Lycorea ceres*, darkest form, only the costal end of the submarginal bar can now be detected, while the inner section of the discal bar is only represented by traces, and its outer part has disappeared. In this important respect *Lycorea ceres* is much in advance of *L. pasinuntia* in the tendency towards progressive darkening: C. B. Roberts, 1901, probably Dec., or 1902, probably Jan.: in Hope Dep.

XXII. *On the Diaposematic Resemblance between* Huphina corva *and* Ixias baliensis. By F. A. Dixey, M.A., M.D., F.L.S., Fellow of Wadham College, Oxford.

[Read December 5th, 1906.]

Plate XXXI.

Among the geographical forms of *Huphina nerissa*, Fabr., there occurs in Java, Bali and Lombok a fairly well-marked island race to which Wallace in 1867 gave the name of *corva*. A similar form, called by Butler from its habitat *H. sumatrana*, seems almost indistinguishable from Wallace's type.

The object of the present paper is to call attention to the remarkable similarity that exists between both sexes, but especially the female, of *Huphina corva*, and certain females of a form of *Ixias* found in the same locality. The *Ixias* in question belongs to the group containing *I. venilia*, Godt., and *I. reinwardtii*, Voll., being indeed scarcely separable from the latter. It is the local race inhabiting the island of Bali, and has accordingly received the name *baliensis* from Fruhstorfer.

The resemblance here spoken of is well seen on Plate XXXI, but is still more striking when the actual specimens are examined. It can, I think, scarcely be doubted that the likeness between these forms of such diverse affinities has a mimetic significance. The specimens represented in Fig. 3–7 were all captured on the same occasion by Mr. R. Shelford, M.A., F.E.S., and were kindly given by him to the Hope Department at Oxford. It does not appear to have been noticed that the series contained an *Ixias* until the insects were on the point of being incorporated with the general collection.

It will be observed that the resemblance to *Ixias baliensis*, though shared by both sexes, is stronger in the female than in the male *Huphina*. This is in accordance with the well-known rule as to the superior means of protection employed by the female sex in correspondence with its

greater needs—a rule which holds good not only in mimicry but also in other kinds of defence. Another point worthy of notice is, that as shown by Figs. 6 and **7**, compared with 6A and 7A, the resemblance borne to each other by the upper surfaces of the two insects does not extend to the lower. This seems to favour the view that the enemies in this instance guarded against are such as attack butterflies on the wing rather than at rest.

But the most interesting feature in the case is the evidence it affords of diaposematism, or the interchange of warning characters between mimic and model. In his original description of *H. corva*, Wallace drew attention to the fact that this form possesses a black border to the hind-wing, "much wider and more defined than in the allied forms" (Trans. Ent. Soc. Lond., 3rd Series, IV, 1867, p. 339). This dark border, as can be seen in Plate XXXI, figs. 3–6, is present in both sexes; it is formed in the female by the fusion of the submarginal row of V-shaped spots seen in Fig. 1 with the actual dark edging of the wing. A somewhat similar feature, though less pronounced, occurs in *H. lichenosa*, Moore, from the Andaman Islands; but in the ordinary allied forms known as *Huphina nerissa, H. phryne, H. copia*, etc., it does not exist. A comparison of Figs. 1 and 2, which represent the female and male respectively of the typical *H. phryne* of continental India, with the figures of *H. corva* in the same Plate, will show the difference referred to by Wallace. This difference is even better marked in the dry-season form of *H. phryne* than in the wet, the latter being the phase here figured.

Now it is in large measure to the presence of this dark border on the hind-wing that *H. corva* owes its correspondence in aspect with *I. baliensis.* It is of course open to any one to assert that the dark border is merely an accidental feature in *H. corva* without any special significance. But when we consider that this feature is practically restricted to that form of the *H. nerissa* group whose range overlaps that of the *Ixias* which it so closely resembles, the conclusion seems at once to suggest itself that the presence of the dark border in *H. corva* is the result of a mimetic approach to the other insect. In this respect, then, the *Huphina* has acted as the mimic and the *Ixias* as the model. If, however, we turn to the fore-wing, we find the process reversed; here it is the *Ixias*

that has departed from the usual aspect of its nearest relatives, becoming in this case the mimic, while the *Huphina* stands as the model. The resemblance has therefore been attained by a process of give-and-take on both sides; nor would it be easy to find a better illustration of the principle of reciprocal change or diaposematism.

It is fair to note that specimens of *H. corva* from Java and the representative form *H. sumatrana* from Sumatra also possess the dark border to the hind-wing, and are not known to be in mimetic association with any *Ixias* found in those islands. It is perhaps unlikely, though not impossible, that a corresponding *Ixias* may yet be observed to inhabit these localities; but in view of well-ascertained facts as regards the shifting of areas of distribution among butterflies it would not be extravagant to suppose that the *Huphina* has somewhat extended, or the *Ixias* has contracted its range since the resemblance was first set up. In any case, we have the fact that the specimens shown in Figs. 3–7 were all caught by the same person in the same place and on the same day. *H. corva* occurs also in Lombok, where its relation with *Ixias reinwardtii*, Voll. ♀, is no doubt the same as with *I. baliensis* in the neighbouring island.

It is to be observed that not all female specimens of *H. corva* show the mimetic approach to *Ixias* in the same degree. The hind-wings are sometimes rather conspicuously veined, as often in the wet-season phase of *H. phryne*; moreover the dark Ixias-like border is less distinct in some specimens than in others. So too, *I. baliensis* ♀ may possess a pale orange suffusion in the central area of the fore-wing. These features, which may possibly be dependent on season, certainly tend when present to impair or abolish the excellence of the mimetic picture.

Mr. Finn, in the "Journal of the Asiatic Society of Bengal," 1895, pp. 621, 624, 626, 635, etc., has produced some direct evidence that *Huphina phryne* is disliked by insectivorous birds (*Liothrix* and *Chloropsis*). There is not, so far as I am aware, any such evidence in the case of *Ixias*. But if the foregoing conclusions are well-founded, it will follow that the association between the two forms here discussed must be synaposematic and not pseudosematic, Müllerian and not Batesian.

Explanation of Plate XXXI.

Fig. 1. *Huphina phryne*, Fabr. ♀.
2. *Huphina phryne*, Fabr. ♂.

These figures (1 and 2) represent the ordinary form from continental India.

3. *Huphina corva*, Wallace ♂.
4. *Huphina corva*, Wallace ♂.
5. *Huphina corva*, Wallace ♂.
6. *Huphina corva*, Wallace ♀.
6A. *Huphina corva*, Wallace ♀ underside.
7. *Ixias baliensis*, Fruhst. ♀.
7A. *Ixias baliensis*, Fruhst. ♀ underside.

The above butterflies (3–7) were all taken by Mr. R. Shelford at Buliling, Bali, on May 19, 1905. The resemblance between *H. corva* ♀ and *I. baliensis* ♀ does not extend to the lower surface, as will be seen on comparing 6, 7 with 6A, 7A. In the dark border of the hind-wing, *H. corva* (3–6) is seen to depart from the aspect of the closely allied *H. phryne* (1, 2) and approach that of *I. baliensis* (7).

Alfred Robinson, phot. Witherby & Co.

All figures are about $\frac{15}{10}$ *of the natural size.*

Diaposematism in the upper-side pattern of *Huphina* and *Ixias* from Bali. The fore wing of the ♀ *Ixias* (7) resembles that of the ♀ *Huphina* (6); the hind wing in the ♂ and ♀ *Huphina* (3-6) resembles that of the ♀ *Ixias* (7). Compare *Huphina phryne* from India (1, 2).

Recent Developments in the Theory of Mimicry.
By F. A. Dixey, *M.A.*, *M.D.*

The remarkable resemblances that exist between certain insects belonging to widely different orders, as, for instance, the likeness borne by some of the 'clearwing moths' to wasps and hornets, have long been known to naturalists. They were interpreted by the older observers as cases of 'repetition' and 'analogy' in Nature. Kirby and Spence were the first to attempt a rational explanation. These authors got so far as to suggest that one species might gain an advantage by resembling another; but the first really scientific account of the matter was given by Bates, who pointed out that certain kinds of butterflies in South America escaped attacks from birds by mimicking the appearance of other conspicuous species which were immune from persecution on account of the possession of distasteful qualities. This resemblance to a distasteful model he considered had been gained by a gradual selection of varieties tending in the appropriate direction.

Bates's theory of mimicry, which was at once accepted by Darwin and met with general approval, marked an important step in advance. It left, however, unexplained the fact that these resemblances occurred, not only between distasteful models and their presumably edible mimics, but also between the distasteful models themselves. To account for this he could only suggest that there must be something in the local or geographical conditions which had a direct effect upon forms inhabiting the same region, causing them, even if widely separated in affinity, to assume a common aspect.

But the existence of large groups of insects with various affinities and a common facies was felt as a stumbling-block in the way of the theory of mimicry until in 1879 Fritz Müller found the key to unlock the difficulty. He showed that if (as experiments, chiefly by Lloyd Morgan, have subsequently proved to be the case) birds had no instinctive knowledge of what forms would be suitable for food and what should be avoided, so that each bird had to gain its knowledge by experience, a certain number of the distasteful forms would have to be sacrificed by each generation of birds until these enemies had learned to leave such forms alone. In other words, each distasteful form would have to pay a tax for its immunity. Now if two distasteful species resembled each other so closely that birds or other enemies did not distinguish between them, the disagreeable experience gained by tasting an individual of one species would be applied to the benefit of the other, and so each of the two species would only need to contribute a portion of the tax, instead of each paying the whole. And what is true of a combination of two species would be equally true of a larger assemblage: the greater number of forms that could be got to share the tax, the better for all. Hence the formation of these large Müllerian groups, or, as they might be called, 'inedible associations,' giving room, no doubt, for a certain amount of Batesian mimicry side by side with them or within their own ranks. It is obvious that the resemblances shown between members of these groups, constituted as they are by insects of widely separated orders, cannot be explained by affinity; while the fact (amongst others) that the resemblances are superficial only, never structural, makes strongly against the view which would attribute them to the direct operation of external conditions. The Müllerian theory, which is rather a theory of common warning marks, or 'synaposematism' (Poulton), than of mimicry proper, may thus be said to hold the field as meeting the facts to an extent of which no alternative explanation has been found capable. Müller's suggestion was first brought to the notice of British naturalists by Professor Meldola; and in its further developments at the hands of Meldola himself and of Poulton, it was accepted both by Wallace and by Trimen, the two naturalists who had done most by their own observations to confirm the validity of the original theory of Bates. It is to be observed that both theories alike postulate the operation of natural selection.

It seemed desirable to seek for further confirmation of the truth of Fritz Müller's interpretation, and this the lecturer has made it his business to do. It appeared to him that if the Müllerian theory were valid, certain consequences ought to follow. Did these consequences follow or did they not?

(1) It is obvious that in Batesian or true mimicry the advantage is all on the side of the mimic. Experience gained by tasting the mimic would be used to the injury of the model. While therefore there is every inducement for the mimic to seek safety by approaching nearer and nearer to the aspect of the model, there is no reason for the model to assimilate itself to the mimic, but rather the contrary.

In a Müllerian association, on the other hand, the benefit is mutual. Each fresh accession to the group is a source of strength, not of weakness. Everything is in favour of the formation of such groups as rapidly and on as large a scale as possible; hence there is nothing to impede, and everything to promote, the free interchange of characters all round, each member being able to act, so to speak, as both mimic and model. This could not happen, as has been shown, in the case of Batesian mimicry.

Several instances of such reciprocity or interchange of features have been detected by the lecturer, and others have since come to light. From what has gone before, it is clear that such cases, inexplicable on any other theory, tend to establish the validity of the Müllerian hypothesis.

(2) A further consequence of the mutual influence exercised by the constituents of a Müllerian group is this: it ought sometimes to happen that two species, though both influenced in common by a third, will show a nearer approach to each other than either does to the common model. As a matter of fact this is found actually to occur in Nature, and fresh evidence is thus supplied for the validity of the Müllerian interpretation. This phenomenon, again, could not happen in Batesian mimicry. Two true or Batesian mimics of the same model could not influence each other; they could only be influenced in common by their model.

(3) Finally, the fact that each distasteful form is capable of affording protection to forms on each side of it may be expected to favour the existence of gradational groups; distasteful forms, with perhaps little or no resemblance between them, being held together, as it were, by a chain of distasteful intermediates. This also has been found to be the case, many of the mimetic groups in a given zoological region forming together a kind of nexus, each node of which may be occupied by a dominant group or species showing a very different colour-scheme from the occupants of the other nodes, while the uniting strands of the network are constituted by a more or less completely gradated series of transitional forms.

It will be seen from the foregoing how far we have advanced beyond the original conception of Bates, and it must be allowed to be a striking fact that the progress of recent investigation has uniformly tended to supply fresh confirmation of those developments of the theory of mimicry which have traced their origin from the fertile suggestion of Fritz Müller.

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1. *Experiments on Seasonally Dimorphic Forms of African Lepidoptera.* *By* F. A. Dixey, *M.A., M.D.*

It is now well known that the phenomenon of seasonal dimorphism is of common occurrence in tropical and subtropical lepidoptera. In those species that produce several broods in the course of the year it is often found that the successive broods differ widely in appearance according to the meteorological conditions prevailing during their immature stages. The contrast between such seasonal phases becomes especially marked in the case of forms inhabiting regions where there is a sharp distinction between the periods of rain and of dry weather.

The succession of these distinct phases is not determined by a regular principle of alternation; for in the instance of quickly breeding forms a series of successive generations may follow one another during the same 'wet' or 'dry' season, all the generations being of the same type, and varying in number according to the duration of the 'wet' or 'dry' conditions in any particular year. But no sooner do the meteorological conditions change than the next emerging brood of the same species shows a corresponding alteration, often sudden, but sometimes so gradual that it appears to take two or more transitional stages to bring the insect up to the full development of the new seasonal phase. This latter phenomenon is especially well marked in the genus *Byblia.*

Experiments have been tried with a view to ascertaining the particular stimulus or combination of stimuli which causes the butterfly to assume its special seasonal form at the appropriate time. In the classical instance of the European *Araschnia prorsa-levana* it was found by Dorfmeister, Weismann, Merrifield, and others that pupæ which left to themselves would have produced the 'summer' form *prorsa,* will if refrigerated give rise to a phase more or less closely resembling the 'spring' form *levana.*

Similar trials have been made with tropical and subtropical species, but until recently with somewhat inconclusive results. Mr. G. A. K. Marshall, however, working at Salisbury in Mashonaland, has now succeeded in showing that by artificially varying the conditions to which the butterflies are exposed in their immature stages it is possible to bring about in the midst of one season the emergence of a form which under natural conditions would only have been produced in the other.

Mr. Marshall has further demonstrated by experiment that the period of growth during which the butterfly is susceptible to climatic influences varies in different species, the critical stage being in some cases confined to the larval, in others to the pupal condition. He has also shown in one instance (that of *Belenois severina*) that the effect of moisture combined with heat differs entirely from the effect of the former factor alone.

Some of the actual results of the experiments referred to are exhibited, the specimens shown belonging to the genera *Teracolus* (*T. achine* Cram. and *T. omphale* Godt.) and *Belenois* (*B. severina* Cram.). The exhibit also includes specimens of other groups to illustrate the general principle.

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OBSERVATIONS ON INDIAN BUTTERFLIES.

BY T. R. BELL.

Reprinted from "The Entomologist's Monthly Magazine," Second Series, Vol. xvii.

[The following interesting notes are extracted from two letters by Mr. T. R. Bell, the first written June 6th, 1903, from Camp Songhir, to Mr. H. E. Andrewes; the second written a year later (June 18th, 1904), to Professor Poulton, from Karachi. They give the impressions of a trained and experienced naturalist, and cannot fail to interest readers of the Entomologist's Monthly Magazine. Only the notes on Natural History are quoted, and thus the communication opens somewhat abruptly.]

In *Kallima* and *Junonia* among the *Nymphalinæ* ; and in *Melanitis*. and, to a lesser degree in the rest of the Satyrine group of butterflies, the seasonal forms are well marked:—in the dry season form by greatly developed hooks to the apex of the fore-wings, and productions or tails to the hind-wings; in the so-called "wet-season" forms, by the presence of ocellation on the under-sides of both wings, which also very often have "ink" markings. The under-side of the dry-season forms is generally plain (as in *Melanitis leda*) with, very commonly, a straight line down the middle in the manner of a leaf midrib; this midrib being present only in the dry-season forms.* The "windows" or hyaline spots in *Kallima*, and white chalky-looking markings are also common; the former chiefly in the dry-season form, the latter in the wet (in *Melanitis aswa* for example). The ink-markings and chalk-markings I am certain are supposed to represent mould and lichens on decaying leaves, amongst which the butterflies are generally found sitting; the hyaline markings are supposed to represent holes in the leaf which *Kallima* imitates.† As the browns of the leaves vary in shade, so do the browns of the under-sides of the butterflies also vary (approaching to grey in the dry-season forms: the leaves at that season being often grey when dead), hardly two in a morning's capture of say twenty specimens being exactly of the same shade. Tell Poulton that

* In *M. leda* and *M. aswa*.

† The words "are supposed to" in the above sentence were considered to require further explanation by Prof. Poulton. Mr. Bell, in reply to his communication, wrote as follows:—"As regards 'are supposed to,' I am afraid that that is what I should always write and say, as I am not at all certain that these characters (inky markings and mouldy-looking markings) would look the same to insects, reptiles and birds that they do to me. Perhaps 'would probably be taken to be' would be better."

I have often bred *Charaxes imna* and *Doleschallia polibete* from the egg in the monsoon, and, although they have been kept quite dry during the egg, larval and pupal stages, they have all turned out monsoon forms: likewise with two *Kallimas* that I remember to have bred from the egg. *Melanitis leda* or *ismene* (wet form and dry form respectively are thus dubbed) bred from eggs laid in captivity in the monsoon (and therefore not rained on) have always given the wet-season form *leda*; not till the end of the monsoon have they turned out *ismene* or the dry-season forms. So also with *Mycalesis mandosa* and *mandata* and *mineus*: the ocellated forms have all been bred in captivity during the rains, from the egg laid in captivity. So that it is not the rain or direct action of wetting by rain that is the cause of the wet-season form. I think it must be the damp atmosphere generally that influences the form. This would be difficult to prove, for when the atmosphere is dry it is next to impossible to keep any space with a damp atmosphere without the larvæ getting diseased and dying. It would be possible in a large conservatory like some of those at Kew, &c., but for us to do it is impossible. In Kanara there are as many broods of butterflies as there are sproutings of leaves; that is, the broods go on in uninterrupted succession all the year round, except that in the hot weather and in the month of October, the two great leaf-sprouting times of the year, the insects are far more numerous than at other times, because there is such a large quantity of available food in the form of young leaves. Of course this is only to be expected in a country which never has any great drought or excessively dry season or any great cold, and where there are always leaves available. I have a theory based upon experience that it is the amount of moisture imbibed or eaten by the larva that produces the wet-season form so-called. This wet-season form in many of the *Pieridæ* (I speak about genera *Appias* and *Catopsilia*, as having come within my experience) is the form which has a great amount of black coloration and rather pointed wings (more pointed in this form in *Appias* any way). Well, I bred many specimens of both these genera (*A. taprobana* and *libythea*; *C. crocale* and *pyranthe*), and found that when fed upon the young succulent leaves of their food-plants which appear in the hot weather, the resultant specimens or imagines are always wet-season forms. Succulent young leaves mean much moisture. In the cold weather, leaves are at their driest and hardest stage, and that is the time all the cold-weather or dry-weather forms are about.

Another thing which is worth noting is that the time occupied from egg to imago is much shorter in the case of the young-leaf fed larva than in the one that is reared on hard, dry leaves. The quickest growth I have ever noticed was that of *Atella alcippe* and *phalanta*, which only took 13 days from egg to imago. Another thing that is usually the case also, is that the cold-weather forms, or those resulting from dry-leaf fed larvæ, are larger than those resulting from larvæ fed on young, wet leaves; it seems, therefore, that the slower the larval growth (always given plenty of food, and fresh), the larger the imago Of course the wet-season or succulent leaf-fed larvæ always produce darker imagines; so that the larger specimens are nearly always, I might say always, lighter in colour than the smaller. Starving larvæ is sometimes productive of curious results, as, in one skipper I bred, and the larva of which I starved, the resultant imago, or imagines, for there were several (it was a *Parnara*) had only one of the semi-hyaline marks showing or present on the fore-wing, and was half the size it should have been; so that de Niceville, of Calcutta, made a separate species of it under the name of *philotas*, de Niceville. I have no opportunity now of breeding and trying experiments; neither, I am afraid, have I a chance of sending Poulton series of the butterflies he wants; if I get back to Kanara, then I shall be able to send them to him. One could write reams on seasonable dimorphism and the effect it shows in different species. For it is a curious fact that in species of the same genus, the line the differences take between the two forms are very different. For example, in *Melanitis* the "rains" form of *leda* and *aswa* show a finely vermiculated surface without a sign of the midrib marking, whereas, in *M. gokhala*, the wet form only differs from the dry in having more "ink" underneath. Whereas *Kallima* shows the midrib on the under-side in wet and dry forms, *Melanitis leda* and *aswa* show no signs of it in the wet forms; whereas the wet forms of *Kallima* and *Melanitis* are darkest on the under-side; and though darker on the upper-side in the wet form, *Junonia asterie* always is lightest in that form beneath. Ocellation of the under-side seems always, without exception, to be an effect of moisture; the wet form of *Junonia asterie*, for example, is abundantly ocellated, whereas the dry-season form is quite plain, with a well-defined midrib.

There is a curious thing in connection with *Doleschallia polibete* which may be interesting, and that is, whereas the male is very active, and continually found perching on leaves near the tops of trees, very often in the open, the female is hardly ever seen out of thick vegetation and dark places; in fact only one female is seen for a dozen or

more males, because, presumably, one frequents generally open places oftener than thick undergrowth in jungles. We found from breeding that, if anything, more females than males are produced from any one given batch of eggs, the eggs always being found in batches of from five or six to fifteen or so; now, in the male, which frequents open places (this insect always sits with its wings closed over its back), there are a number of white marks, very conspicuous at and near the base of both wings; in the female these are always entirely wanting, the under-side in that sex being plain, with the midrib distinct. Difference in size is always due to sufficiency, or otherwise, of food (that is apart from the seasonal-form difference in size); and those species whose larvæ feed upon a food which grows in great quantities covering miles of country, very rarely, if ever, show any difference in size, as *Kallima*, which feeds on *Strobilanthes*, an under-shrub which sometimes covers whole jungles, and *Melanitis*, which feeds on grasses and rice or bamboos. I remember one year when *Catopsilia crocale* and *Badamia exclamationis* (a skipper) were so abundant as to denude every tree in the forests of their leaves (their food-plants being *Terminalia belerica*, one of the largest and commonest forest trees we have; and *Cassia fistula*, also a common tree, but smaller); the larvæ, when no more food was to be had on any tree, came down the stems in such numbers as actually to cover them to the extent that there was not room to touch the bark with a tip of a finger. Well, in that year, the differences in size of specimens of these two species was very marked.

The habit of lying torpid in the imago state in this part of India (Kanara) has never come to my notice. Certain species of larvæ lie over for months sometimes (*Tagiades atticus* for example—a skipper), and other butterflies lie over in the pupal state as some of the *Papilios* (most notably *P. nomius* and *panope* or *dissimilis*), but these butterflies have no definite seasonal forms. *Papilio nomius* as imago is only found in the months from February to June, and never (as far as I know) in the months from July to January. This is rather queer as the food-plant (*Saccopetalum tomentosum*) has leaves all the year round, but it is in young leaf in the hot weather only: hence probably the reason, the larva of the insect being probably so constituted that it cannot chew hard leaves, or its stomach so formed that it cannot digest them. Another curious thing is that, whereas in *P. nomius* the the larval and egg stages are normal in length, the pupal stage is so long; in *Tagiades atticus*, on the other hand, the larval stage is long, while the egg and pupal stages are normal: at the same time it may

be as well to state that the feeding period of the larva in this latter insect is quite normal: the larva turns transparent green at the end of the feeding (as usual) and in that state lies over, sometimes a short time, sometimes a long time, depending on I know not what causes; is quite active, as it often changes its cell, and never omits to change it just before pupating.

[This concludes the notes in the first letter, which was sent by Mr. Andrewes to Professor Poulton who replied to it direct to Mr. Bell. The second set of notes constitute nearly the whole of Mr. Bell's answer.]

Thanks for the book containing the different papers; those African *Precis* are indeed wonderful in their variety or variation. We have nothing quite as variable as that, except some of the *Catophaga-Appias* lot, which even then only vary from black to white; nearly quite black all over, however, to nearly pure white; the black forms being the wet-season ones of course, or the "succulent shoot" forms, which I fancy is the same thing. These shoots come out in end of April and May—which is the hot weather; and dry, and last through the rains. Our *Precis*, the common one existing right through India into China (now called *Junonia iphita*), becomes very black (dark brown) in the rains, gets smaller peaks to the wings, that is, the peaks are less accentuated, and besides the tendency to ocellation, gets a steely suffusion on the under-side: the only butterfly I am acquainted with that acquires metallic marking. There is another thing, while on *Precis*, which occurs to me, and that is the rule that the dry forms are the larger does not always apply to *Precis*, and never to some other species. For example, the wet-season form of *Hypolimnas bolina* is more than double the size (wing-area) of the dry-season form; the same with *Hypolimnas misippus*, also *Cynthia saloma* and *Cethosia mahratta*. Now the reason for this is that the dry-season forms of these butterflies are all more or less starved specimens. The *Acanthaceæ*, on which *Precis* and *Hypolimnas* feed, and *Modecca* (*Passifloreæ*, the food-plant of *Cynthia* and *Cethosia*) are almost completely wet-season plants, that is they lose their leaves in the dry weather. Barring this starving, all cold-weather forms are larger than the wet-weather ones, and are so, I consider, for the reasons I have given before, viz., slower growth due to less "sappy" food.

In these very damp regions, like Kanara, where the rainfall varies from 100 to 300 inches, the leaves often get spots of white mould on

them: a sort of very soft, feathery white fungus which is a few millimetres in diameter, and circular as a rule; besides which, the circular burrowings beneath the epidermis of leaves of minute Lepidopterous, etc., larvæ become quite white in the withered leaf; so that the chalky markings, so distinct on *Melanitis aswa* in the cold-weather forms, might be mistaken for this latter style of thing. The rains form of *M. varaha* is all vermiculated underneath like *leda.*

The two species of *Kallima* which I have bred from the egg are *K. wardi* (cold-weather form = *K. horsfieldii*) and *Doleschallia polibete*; the latter we always called the red *Kallima.* As I have been transferred from Kanara, and am at present in this desert place, I cannot do anything in the way of experiment as there is a great lack of material and I have few of my things with me, having left all my collections, &c., down in Kanara. Our ways of breeding in Kanara were to all intents and purposes quite natural as all the plants grew immediately outside the bungalow which are situated in the jungles; often, indeed, we just tied large nets over the trees on which the larvæ were feeding: this *à propos* of your remarks as to the time *Atella alcippe* takes from the egg to the imago.

With reference to the curled leaves: after the rains nearly all the leaves curl up in drying, and I have often been struck by the curious resemblance some of them bear (especially when hanging in a spider's web, &c.) against the trunk of a tree, surface of a rock, branch of a tree, &c., to a *Kallima* or similarly peaked- and hook-winged butterfly; the resemblance in colour and shape is sometimes so strong as to quite deceive one from a short distance. In the rains, curled leaves are scarce in wet places like Kanara, as you may imagine. Some favourite seats for *Kallima* butterflies are a tree-trunk, branch, or perpendicular rock surface, also small masses and strings of dead leaves hanging by remnants of old spider webs in the undergrowth in the jungles. I have never seen a *Kallima rest* on the ground though they often settle for a short time; whereas *Melanitis* always rests on the ground and, as your book says, generally in a half-lying position amongst the leaves, rarely upright. I have often looked in vain for Satyrines that I have watched carefully settle without being able to find them except after carefully scanning every inch of the ground.

As to the habits of butterflies at different seasons, I do not think there is any more activity during the dry season than during the wet; of course the number of insects about during the wet months is more than double that which one sees during the dry months: this is accounted for by the more prolific breeding owing to greater quantity

of food. There are always two great seasons in the damp parts of India, one in the month of April, just touching March and May, and one, by far the "heaviest," as the natives say here, in the months of September and October, which exactly correspond to the two great shooting times of the trees and plants of all kinds; nearly all the trees flower twice in those parts, also, as you might suppose, there being two sprouting seasons.

When we were breeding butterflies in Kanara we found that males and females came out in equal numbers; which fact surprised us much at the time, for certain species, of which one seldom or never sees the female, such as *Charaxes imna* and *schreiberi* (*wardi*), *Euripus consimilis* and many of the "blues." When one does come across them it is always in the underwood in the jungles, while the males bask openly in the sun on the tops of high trees, on leaves by the road-side, &c. In Karwar (North Kanara) we had rare opportunities for observing this as the top of a hill close by was 1500 feet above sea level where we lived (Karwar is on the sea-beach), and the trees on the summit of this hill are all stunted by the strong winds and are overtopped in places by huge boulders where we could stand and observe, having a view all round of land and sea, hill and plain for 40 miles on every side. Here, on muggy days in the monsoon, when the mists were driving over the top of the hill from the Indian Ocean, causing intervals of strong hot sun, light and cool shade, on the summit, butterflies used to come in the sunny breaks in the mist and settle in hundreds—I had nearly said thousands—on the surrounding leaves; the air at times used to be thick with them chasing each other and generally enjoying themselves. All these butterflies, without exception, were males; a stray female would come up through the underwood now and then, but never to stay. A female *Charaxes imna* or *schreiberi* or *Cynthia saloma* was an event not to be forgotten, in fact I only remember once seeing one of the last. We learnt a lot about the habits of butterflies in those days: what species were "baskers" and what were not for example. *Cynthia saloma*, and five species of *Charaxes* (*imna*, *wardi*, *schreiberi*, *fabius* and *athamas*) were the most persistent "baskers" of the lot: then there were "blues" of the genera *Virachola*, *Camena*, *Curetis* and *Tajuria*; *Euthalia lubentina* and *garuda* would come along later in the day; skippers of the genera *Bibasis* (*sena*), *Hasora* (chiefly *chromus*), *Halpe moorei*: *Athyma inarina* and *mahesa* and occasionally *A. selenophora*. None of the *Papilios* or Pierines ever used to bask; the only *Papilio* that ever came up to the top for the sun was *panope* (= *dissimilis*), and then

chiefly the *panope* form: and they would fly backwards and forwards over the trees, but rarely settle. *Papilio helenus*, *tamilana*, *pammon*, *liomedon*, would come past in the underwood but never settled: and all were males, without exception. The "baskers" would sit with their wings half open as a rule, except *Euthalia*, which always sat with its wings spread widely out on a leaf. It is noticeable that all the "baskers" are strong, powerful butterflies, so have little to fear from birds; the weak, brightly-coloured butterflies never seemed to come and bask; the strong ones are, of course, often conspicuosly brightly-coloured too. By the way, when a *Papilio* settles in the underwood, which of course they constantly do in shady places, they invariably sit with the front wing brought down to cover the bright markings on the hind-wing: I am particularly thinking of *P. tamilana* (with a bright peacock-blue large spot on the hind-wing—belonging to the *P. paris* group); *P. helenus* (called *daksha* in South India, has a white spot where *tamilana* has it blue), *pammon* and *liomedon* (with white markings on the hind-wing), &c., &c. These *Papilios* always rest with their wings spread. Others, such as *P. telephus*, *sarpedon*, *nomius*, *agamemnon*, &c., always rest with the wings closed over their backs.

Has any explanation ever been offered as to the meaning or use of the anal black, often silver- or orange-centred spots on the hind-wings of some *Lycænidæ*? Or have you ever looked at them yourself? Put a "blue" having such spots (*Virachola*, *Camena*, *Ops*, *Creon*, *Arhopala*, &c.) on a leaf or surface in its natural position, with the wings closed over the back; the black spots then come into juxtaposition with a flimsy tail to each one, which moves in the tiniest breeze. Looking one day at a "blue" on a leaf in the jungle, I took the spots for the head of a *Mantis*! And, as if the resemblance were not strong enough when at rest, the movement so common among *Lycænidæ* of the hind-wings one on another (as if the butterfly were rubbing them together gently) gave the "*Mantis*-head" the appearance of moving from side to side. It was very quaint. And it struck me forcibly that it would do well to frighten small insects, ants, &c. Or perhaps birds and lizards would take it for a *Mantis* and thus get the ends of the wings instead of the *Lycænid's* body?

But there is no end to this sort of observation; one might go on for ever at it.

May, 1906.

XIII. *On the habits of a species of* Ptyelus *in British East Africa.* By S. L. Hinde. Communicated, with Notes, by Professor E. B. Poulton, F.R.S.

[Read June 6th, 1906.]

Plate XIII.

[Mr. S. L. Hinde, in a letter written from Fort Hall, British East Africa, Jan. 12, 1903, gives the following account of the locality and mode of occurrence of an insect which is closely allied to *Ptyelus flavescens*, F., if indeed it is not actually the same species.—E. B. P.]

"I have started a new station, which ought to be a nice collecting ground. It is perhaps 6000 ft. altitude, on the east of Kinangop * and Sattima, *i. e.* Aberdare Range: the bamboo is only about six or seven miles away. The Bamboo Forest is about 9000 to 11,000 ft. altitude. Kenya (17,200 ft.) is about fifty miles away, across the Tana Valley.

"I send you a most interesting insect, which grouped resembles flowers in the imagines and fruit or buds in the larva; it is a cuckoo-spit we found on the banks of the Chania River (where I have placed the new station); the Chania River is a large one, not marked on any map. The insects were on a large tree, perhaps 40 ft. high, and almost every branch was covered with insects, and there was a continuous drip under the tree like rain from their secretions. When within 6 to 10 ft. or more of the insects they looked like flowers and fruit or buds. On the ground there were larvæ and imagines, singly and in groups, that had fallen off the tree. I broke off a branch covered with insects and brought it to the tent. Mrs. Hinde made sketches at once, which we send by this mail. I send you also a box of the insects which have already faded."

Notes by Professor E. B. Poulton.

The specimens sent by Mr. Hinde in illustration of his remarks are to be seen in the British Natural History

* In a letter, dated July 2, 1906, from Fort Hall, Mr. Hinde writes:—"Kinangop on many maps, real name Nandarua (altitude 13,000 ft.), is the southern end of the Aberdare or Sattima Range. The insects were found on the Chania River (altitude 5,800 ft.) on the ground that is now Nyeri Government Station, sixteen miles north-east of Nandarua."

Museum and the Hope Department, Oxford University Museum. They were compared by Mr. C. O. Waterhouse and myself with specimens of *Ptyelus flavescens*, F., in the British Museum, and probably belong to this species, allowing for the change of colour described by Mr. Hinde and shown by comparison with Mrs. Hinde's paintings, representing an insect for which *flavescens* would be a most appropriate name.

The locality given on Mrs. Hinde's drawings is Nyeri.

The native name of the tree appears on the drawings as "Muroha." I have sent Mrs. Hinde's careful drawing of it to Kew, and the Director kindly informs me that it is probably a species of *Heptapleurum* (*Araliaceæ*).

Livingstone observed in Angola an insect evidently allied to the *Ptyelus* painted by Mrs. Hinde.* He speaks of it as congregating in small companies of seven or eight on the smaller branches of trees of the Fig family. Such a group would produce three or four pints of fluid in the course of a night. He does not enable us to infer whether many companies inhabit a single tree, but the impression is produced that the numbers are very much less than those described by Mr. Hinde and shown in Mrs. Hinde's drawings. Livingstone believed that the fluid was derived from the atmosphere and not from the tree and made some experiments which appeared to support his opinion. They are however unconvincing, while so improbable a contention demands for its establishment the most incontrovertible of evidence.

Dr. David Sharp, F.R.S., gives the following account of two species with habits somewhat similar to those described by Mr. Hinde:—"In Madagascar it is said that *Ptyelus goudoti* exudes so much fluid that five or six dozen larvæ would about fill a quart vessel in an hour and a half† . . . In Ceylon the larva of *Machærota guttigera* constructs tubes fixed to the twigs of the tulip-tree, and from the tube water is exuded drop by drop." (Cambridge Natural History, Insects, Pt. II. London, 1899, pp. 577, 578.) This latter fact is opposed to Livingstone's hypothesis, inasmuch as the tube would tend to hinder contact with the air.

The interpretation of the copious exudation is almost certainly to be found in the relatively small amount of

* "Missionary Travels and Researches in South Africa," pp. 415–417. London, 1857.

† See also Westwood, Introd. Mod. Class. Ins., Lond. 1840, vol. ii., p. 433.

nutriment contained in the sap, so that a great quantity must pass through the body of the insect in order to yield a sufficient supply of food. Analysis of sap drawn direct from the tree as compared with that of the fluid which has passed through the body of the insect might well yield interesting results bearing upon the physiology of insect nutrition.

The frothy covering is a good example of the utilization of an excretory substance for the purposes of defence, entirely analogous to the covering of fæces constructed by many larvæ, the calcium carbonate in the form of minute arragonite crystals rubbed into its cocoon by *Bombyx neustria*, or the hardened paste of calcium oxalate excreted and made use of by the larva of *Eriogaster lanestris.*

Dr. David Sharp (l. c. p. 578) makes the following statement concerning the protective value of the froth :—" The frog-spit is considered by some naturalists to be a protective device; the larvæ are, however, a favourite food with certain Hymenoptera, which pick out the larvæ from the spits and carry them off to be used as stores of provisions for their larvæ." It is strange that Dr. Sharp should quote this observation as if in refutation of the opinion that the secretion is protective. I do not know of a single naturalist, except the late Dr. Haase, who holds or has held that any defence of this kind is effective against all enemies and that universal immunity is thereby conferred. Such a conclusion is unthinkable, and yet it is the only conclusion controverted by Dr. Sharp's statement. The category of special defences to which belongs the covering of froth involves conspicuousness and easy capture by special classes of enemies. But can it be doubted that the adaptation confers nevertheless a balance of advantage in the struggle for existence? The justification of any such doubt requires evidence on a very different scale from that brought forward by Dr. Sharp.

The method by which the froth is produced has been misunderstood and erroneously described probably by every author who has written upon the subject, until it was studied by my friend, Professor E. S. Morse of Salem, Massachusetts. Even his account is but little known by entomologists, because published in a somewhat unusual channel.* The general statement has always been that

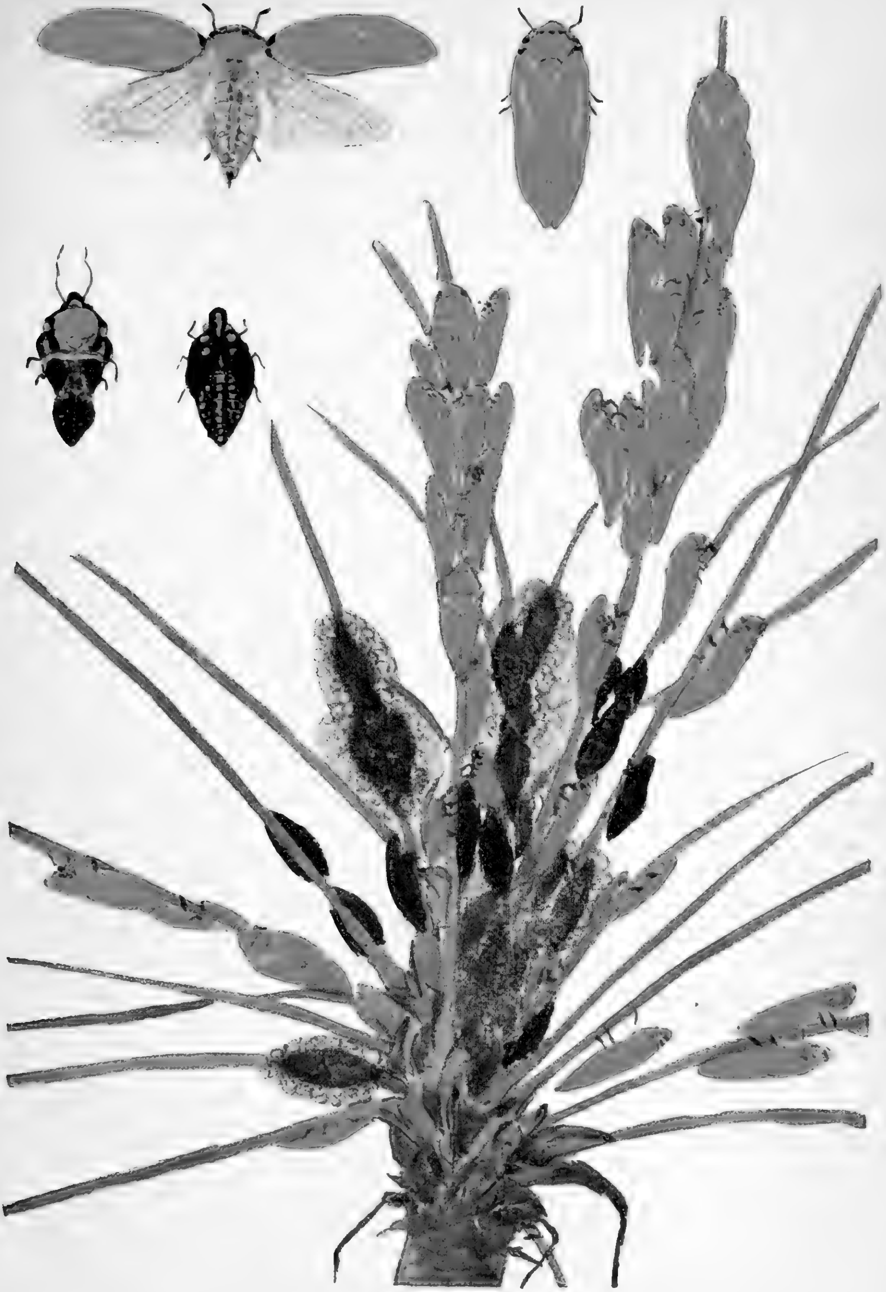
* At first in an elementary book on zoology : later in Appleton's ' Popular Science Monthly " for May 1900, p. 23.

the *Aphrophora* secretes or emits the froth from its body. Thus Dr. Sharp summarizes the older opinion in the following words:—". . When in the immature stages, certain of them [*Cercopidæ*] have the art of emitting the liquid in the form of bubbles which accumulate round the insect and conceal it" (l. c. p. 577). Professor Morse shows that when the insect is cleared from the bubbles and placed on its food-plant, "it will crawl quite rapidly along the stem . . . , stopping at times to pierce the stem for the purpose of sucking the juices within, and finally settling down in earnest, evidently exerting some force in thrusting its piercing apparatus through the outer layers, as shown by the firm way in which it clutches the stem with its legs. After sucking for some time, a clear fluid is seen to slowly exude from the posterior end of the abdomen, flowing over the body first and gradually filling up the spaces between the legs and the lower part of the body and the stem upon which it rests. . . . During all this time not a trace of an air-bubble appears; simply a clear, slightly viscid fluid is exuded, and this is the only matter that escapes from the insect. . . . This state of partial immersion continues for half-an-hour or more. . . . Suddenly the insect begins to make bubbles by turning its tail out of the fluid, opening the posterior segment, which appears like claspers, and grasping a moiety of air, then turning the tail down into the fluid and instantly allowing the enclosed air to escape. . . . These movements go on at the rate of seventy or eighty times a minute. At the outset the tail is moved alternately to the right and left in perfect rhythm, so that the bubbles are distributed on both sides of the body, and these are crowded towards the head till the entire fluid is filled with bubbles, and the froth thus made runs over the back and around the stem." Many other interesting facts and observations are recorded in this paper which should, I think, be reproduced in a more accessible form, together with the simple but entirely adequate illustrations. The probability of some accessory aid to respiration by means of thin-walled leaf-like appendages is also discussed. The whole problem of the respiration of the insect enclosed in its mass of froth would be a fascinating subject of inquiry. The mere contemplation of it is enough to bring home the utter improbability of the older view as to the origin of the included gas.—E. B. Poulton.

Explanation of Plate XIII.

The main drawing of the larvæ, etc., on the tree was made from life by Mrs. S. L. Hinde on Dec. 5, 1902. It is reduced to about $\frac{3}{4}$ of the natural size.

The two drawings of the perfect insect with wings expanded and closed respectively and the two drawings of the immature stages were made from life by Mrs. Hinde on Dec. 2, 1902. These are unreduced.



H. Hinde. Andre & Sleigh, Ltd.

Separate insects, natural size: chief drawing about ¾.

Ptyelus sp., probably *flavescens* F. upon an Araliaceous tree in the Aberdare Range, British East Africa, Dec. 2—5, 1902.

10

XX. *A permanent record of British Moths in their natural attitudes of rest.* By A. H. Hamm, Assistant in the Hope Department of Zoology, Oxford University Museum. Communicated by Professor E. B. Poulton, D. Sc., F.R.S.

[Read November 21st, 1906.]

Plate XXIX.

Naturalists have often described the remarkable harmony between many of our common insects and their environment. Indeed no one can have collected or observed insects without noticing this for himself, particularly in the species which usually rest upon tree-trunks, rocks and walls.

Although the art of photography has recently made such rapid strides and has been utilized so successfully to demonstrate and record many of the processes and facts of Nature, very little has been done, so far as I am aware, to illustrate by its means the attitudes and resting habits of our common insects. Now, however, by the development and perfection of "half-tone" illustration, figures can be multiplied to an indefinite extent easily, inexpensively, and so far as the printing is concerned in a permanent form. The paper it is to be feared is "another story," and one which requires, but has not as yet received serious consideration on behalf of posterity. The natural histories of British insects of the immediate future will I believe be largely illustrated in this way, and the present paper is an attempt to demonstrate the feasibility and success of the method.

Any one unacquainted with living insects in their natural surroundings entirely fails to appreciate and value the various colours and patterns seen on glancing through a collection of insects, more especially Lepidoptera. Even less is he able to understand their meaning in the illustrations of the numerous works on the subject. It is not too much to claim that the figures on Plate XXIX are

not open to this criticism, and that the moths represented tell their own story at once to experienced naturalist or beginner alike. And this is just because the figures are an accurate register of the insects in positions assumed by them on surfaces chosen by them.

Fig. 1 on Plate XXIX shows the male of *Hybernia leucophæaria*, Schiff., one of the commonest and earliest moths to appear in our oak woods. The example here shown is fairly typical of this extremely variable insect. The figure shows the moth in its characteristic attitude with the body approximately horizontal. The object of this position is also well seen, viz. in order to bring the dark markings or bars of the fore-wings into parallelism with the dark lines of shadow in the main fissures of the oak bark. Thus the attitude has an obvious procryptic meaning. In this and in all the other figures illustrating this paper the natural orientation of the moths was carefully preserved on the negatives and is now recorded on the Plate.

Another very common species, *Tephrosia biundularia*, Bork., occurs in nearly every wood throughout the country. In the south where the pale typical form occurs unmixed with others the insect is far more conspicuous than *leucophæaria*. This is especially the case when it is found on one of its usual resting places, the dark bark of the larch. On oak, however, it is far less prominent. Fig. 2 represents the female at rest upon this tree in its usual attitude, which is to be interpreted in the same manner as in the species last described. The asymmetrical position of the wings is doubtless due to the costal margin of the right fore-wing being fitted closely against the side of the vertical fissure in the bark. Had the attitude been symmetrical both sides of the fissure would have been entirely covered by part of one wing and a more conspicuous effect produced.

Eupithecia abbreviata, St., as every one knows who has had experience of "trunk-searching" for "Pugs," is very difficult to find when at rest upon oak; so much so indeed that collectors generally prefer to hunt the smooth stems of the underwood, where it is far more easily detected. In Fig. 3 is seen a specimen of this common "Pug" fitting into a depression in the bark of an oak, and the beautiful manner in which it harmonizes with its environment is very evident. The main lines of the moth's

markings are seen to be rendered vertical by the attitude, as in the moths represented in Figs. 1 and 2.

Among the moths which are usually found at rest upon rocks or stone walls the species of the genus *Bryophila* are probably the best known. The well-known *B. perla*, Fabr., is so common everywhere throughout the country that very little need be said of it. The range of variation in this moth is not very great, although in a few districts it tends to resemble some local peculiarity in the prevailing tints of the walls upon which it both feeds as a larva and rests as an imago. A typical example is shown in Fig. 4, upon an old, lichen-covered, stone wall. The peculiar grey lichen-like markings of its fore-wings are seen to blend almost perfectly with the surface upon which the moth is resting. *B. muralis*, Först. = *glandifera*, Hübn., is a species chiefly confined to our southern coasts and presents an interesting contrast to *B. perla* in its great variability, ranging, as it does, from a grey through a number of intermediate shades to a very dark green. This wide range of variation may be seen in a single district, as I have found in the locality in which I have chiefly observed it, viz. South Devon, where however the darker forms predominate. By this great variability the species is much aided in the struggle for existence in localities where stone walls and rocks are as varied in hue as they are in South Devon. Fig. 5 shows one of the darker forms which are extremely well concealed on many of the walls. In this particular instance the moth was rather more conspicuous than usual. Fig. 6 is an example of the yellowish-green form, which is less common than the other. It is however equally well protected when at rest on walls or rocks covered with yellowish-green lichens. It is to be observed that the moths of this genus adopt no special orientation in their attitudes of rest, a fact which is in correspondence with the irregular growth of lichen-masses on stone.

Explanation of Plate XXIX.

Photographed direct from nature, natural size.

The orientation of the living insects is accurately recorded on the plate in every case.

Fig. 1. *Hybernia leucophæaria*, Schiff., ♂, at rest on an oak trunk with head to the right, about 3½ feet from the ground, Bagley Wood, near Oxford, March 9, 1902.

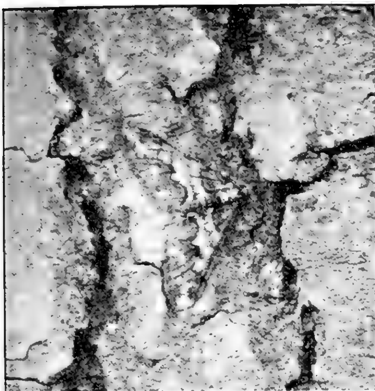
2. *Tephrosia biundularia*, Bork., ♀, at rest on an oak trunk with head to the right, about 3 feet from the ground, Henwood, near Oxford, May 10, 1902.

3. *Eupithecia abbreviata*, St., at rest on an oak trunk in a crevice of the bark, about 1½ feet from the ground, Henwood, near Oxford, April 27, 1902.

4. *Bryophila perla*, Fabr., at rest on an old lichen-covered stone wall, 3½ feet from the ground, Cheyney Lane, near Oxford, August 23, 1902.

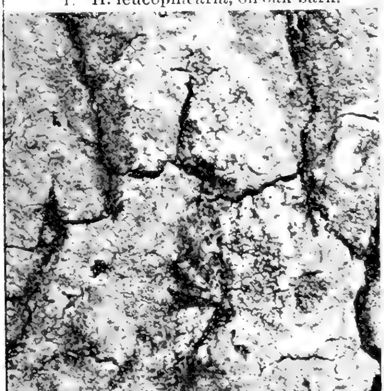
5. *B. muralis*, Först. = *glandifera*, Hübn., at rest on a stone wall 2 feet from the ground, Newton Abbot, South Devon, August 15, 1902.

6. *B. muralis*, at rest on an old lichen-covered stone wall, 3 feet from the ground, near the Coast Guard Station, Dawlish, South Devon, August 13, 1902.



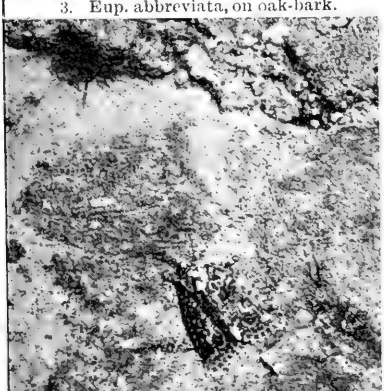
1. H. leucophæaria, on oak-bark.

2. T. biundularia, on oak-bark

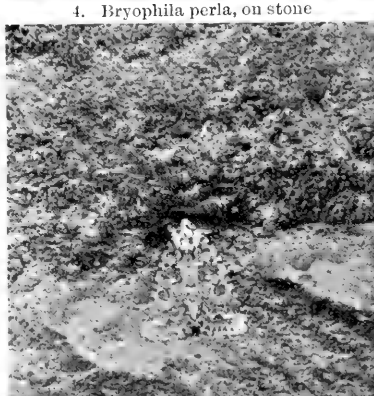


3. Eup. abbreviata, on oak-bark.

4. Bryophila perla, on stone



5. Bryophila muralis, on stone.



6. Bryophila muralis, on stone.

A. H. Hamm, phot. All figures are the natural size. *Andre & Sleigh.*

British Moths in their natural attitudes of rest on Bark or Stone.
Photographed from Nature in 1902.

XVI. *Predaceous Insects and their Prey.* By Edward B. Poulton, D.Sc., M.A., LL.D. Princeton, F.R.S., Hope Professor of Zoology in the University of Oxford, Fellow of Jesus College, Oxford.

PART I.

Predaceous Diptera, Neuroptera, Hemiptera, Orthoptera, and Coleoptera.

[Read June 6th, 1906.]

Contents of Part I.

Introduction to Part I.

The following memoir, including numerous and varied groups of insects, has made large demands on the time and work of many naturalists. It is a pleasant duty to speak of the extremely kind and sympathetic help by which alone the publication has been rendered possible: help in bringing together a large mass of original records; help in working out the material and in searching through the literature of the subject. I must admit that in the desire for the utmost fulness and precision in the data and the determinations, my friends have been somewhat burdened with correspondence: the one to whom I owe the most even likened me to a "pom-pom"! I fear indeed that among the chief reasons for welcoming the final appearance of the paper will be a feeling of relief and security, of a haven of rest where the inexorable letter-writer will cease from troubling.

In addition to the solid contributions of material upon which this paper has been built, the unceasing contact with sympathetic friends has been in itself a source of encouragement and inspiration. Where is there a subject the equal of natural history in bringing about friendly co-operation in the labour of accumulating evidence or of solving some difficult problem?

The material of this memoir is far more due to the efforts of Colonel J. W. Yerbury than to any other naturalist. It was chiefly but by no means exclusively collected in the British Islands, and has contributed to nearly all the groups of predaceous insects. In the section devoted to *Empidæ*, the specimens collected by Colonel Yerbury more than equal those obtained by all other naturalists put together.

Next in importance is the splendid series of examples collected by Mr. Guy A. K. Marshall in South Africa, the great majority from the neighbourhood of Salisbury,

Mashonaland. During the past five years Dr. T. A. Chapman has presented to the Hope Department a fine series of predaceous insects and their prey from a number of European localities, chiefly Spain. Mr. H. St. J. K. Donisthorpe has for many years presented valuable material in many groups of predaceous insects from numerous British localities. In the course of a visit to La Granja in the Sierra Guadarrama, Spain, I was able, in July 1902, to make a considerable collection of Asilid flies and their prey, and in particular to study the habits of *Dasypogon diadema*, which is very abundant in that locality.

Small collections of material making up altogether an important part of the foundation on which this paper rests have been contributed by the following naturalists:—Mr. C. N. Barker and Mr. F. Muir from the neighbourhood of Durban, Natal; Mr. S. A. Neave, from N.E. Rhodesia; Rev. K. St. Aubyn Rogers, from British East Africa; Lieut. T. Bainbrigge Fletcher, from Port Sudan; Mr. E. E. Green, from Ceylon; Col. C. T. Bingham, from Burma; Dr. Richard Evans, from near Penang; Mr. J. C. Kershaw, from Macao; Rev. F. D. Morice, Monsieur Chretien, Mr. G. C. Champion, Mr. W. Holland, and Mr. A. H. Hamm, from Spain.

Small collections from British localities have been presented by Mr. Edward Saunders, F.R.S., Dr. G. B. Longstaff, Mr. W. J. Lucas, Mr. A. H. Hamm, and Mr. J. Collins; and single examples by Commander J. J. Walker, Mr. R. Shelford, Mr. W. Holland, Mr. A. J. Chitty, Mr. L. D. Saunders, Mr. H. A. Saunders, Mr. J. E. Collin, and Mr. E. A. Cockayne.

Many naturalists have rendered kind assistance by drawing attention to published or manuscript records. Many interesting British records, several of them now published for the first time, were kindly communicated by Colonel J. W. Yerbury and Mr. Claude Morley; and valuable help of the same kind was afforded by Mr. G. H. Verrall, Mr. J. E. Collin, Mr. G. C. Bignell, and Mr. G. T. Porritt. Mr. W. L. Distant kindly drew my attention to many published records of the attacks of predaceous insects, especially in South Africa.

It is equally pleasant to acknowledge all the kind help received in working out the material, half of which, viz. the prey, was generally in bad condition and very difficult to determine. Here also I am chiefly indebted to Colonel J. W. Yerbury, who has devoted an immense amount of time and labour to the largest part of the collection, the

Diptera. In this group very kind help has also been received in special cases from Mr. G. H. Verrall, Mr. J. E. Collin and Mr. E. E. Austen. In working out the Neuroptera kind assistance was received from Mr. W. J. Lucas, Mr. W. F. Kirby, Mr. Kenneth J. Morton and Mr. C. A. Briggs; the Orthoptera, by Señor Don Ignacio Bolivar, Mr. W. F. Kirby and Mr. R. Shelford; the Lepidoptera, by Sir George F. Hampson, Dr. F. A. Dixey, Mr. J. Hartley Durrant and Mr. R. South; the European and British Rhynchota, by Mr. Edward Saunders, F.R.S.; the Rhynchota from other parts of the world, by Mr. W. L. Distant; the Coleoptera, by Commander J. J. Walker, Mr. Guy A. K. Marshall, Mr. G. J. Arrow, Mr. C. J. Gahan, Mr. G. C. Champion, and Mr. W. Holland.

The Hymenoptera have been especially difficult. Mr. Edward Saunders, F.R.S., has determined the European and British Aculeates; Colonel C. T. Bingham, the Oriental and African Aculeates and Parasitica; Mr. Claude Morley, the European and British Parasitica; Rev. F. D. Morice, the European and British *Tenthredinidæ*; Mr. A. J. Chitty devoted much time to the difficult problem presented by a minute Cynipid.

A minute species of Collembola, which had puzzled many naturalists, was finally traced to its true position by Mr. Claude Morley.

The British Spiders have been kindly studied by Mr. F. P. Smith, but the results of his labours are almost confined to the material for Part II.

Special inquiries have been courteously answered by Mr. C. O. Waterhouse, Mr. G. T. Lyle, Mr. H. O. Forbes and Mr. W. R. Ogilvie-Grant, as well as by the naturalists whose names have been already mentioned.

Numerous errors are so difficult to avoid in a memoir of this kind, dealing with such varied material and bristling with data, that exceptional time and trouble have been devoted to the correction of proofs. Not only have they been read several times by the writer, but the following friends have also most kindly been through them and made many corrections and valuable suggestions:—Mr. Edward Saunders, F.R.S., Colonel J. W. Yerbury, Mr. G. H. Verrall, Mr. J. E. Collin, Mr. Claude Morley, Mr. G. A. K. Marshall, and Commander J. J. Walker. Mr. W. J. Lucas read through the proofs of the Neuroptera. Mr. Marshall also rendered the kindest assistance in bringing together upon a single copy the corrections on six sets of

proofs. Mr. R. Shelford, M.A., and Mr. A. H. Hamm have not only read proofs, but they have also greatly helped me in comparing them with the data on the specimens. It is impossible to hope that mistakes have been entirely avoided, but at any rate exceptional labour has been expended upon their reduction to the lowest possible number.

The present memoir was undertaken in order to determine, as far as possible, the enemies of those groups of insects which are believed on good grounds (see especially Mr. G. A. K. Marshall's experiments recorded in Trans. Ent. Soc. Lond. 1902, pp. 292—405) to be specially defended against entomophagous Vertebrates. So far from following Haase in the belief that such groups enjoy absolute immunity from all attacks, including those of parasites, it seemed probable that the lessened exposure to Vertebrate enemies would be largely compensated by a relatively increased exposure to predaceous Invertebrata, and especially insects. And this conviction has been confirmed even more fully than would have been anticipated from the limited extent of the recorded material. Thus it will be found from African records alone that the widely mimicked *Limnas chrysippus* has been seen to be devoured by an Asilid fly, a large Dragonfly, and a Locustid; while another species of Locustid and a large wasp have been found eating the larva. Attacks by predaceous insects upon the specially defended groups of Coleoptera, and upon the stinging Hymenoptera are also proportionately numerous.

It was originally intended to conclude the present paper with a large number of records of predaceous Hymenoptera and their prey, chiefly due to the energy and power of observation of Mr. A. H. Hamm, who is especially devoted to the study of the Fossorial group. It was not at first contemplated that any attempt would be made to search through the vast literature of this subject, extending through two centuries and a half. This widening of the field of work was brought about through a misunderstanding. I wrote to my kind friend Mr. Edward Saunders for records of attacks by Fossors, meaning such records as are contained in his note-books or on the specimens in his collection. In reply he sent me a most valuable abstract of recent literature on the subject, and expressed the opinion that a list of the published records was greatly needed. Under these circumstances Mr. A. H. Hamm began to search systematically and was soon aided by Mr. R. Shelford and Commander Walker. A little later

Mr. G. A. K. Marshall joined in the work, and after a time convinced me that it would be better to defer the records of predaceous Hymenoptera to a second part. So much has been done that the paper would appear to be a complete abstract of literature bearing on the subject; and if it failed to be truly complete great harm would be done; for the way to an adequate statement would certainly be barred for many years to come. It was therefore determined to put off the appearance of Part II, devoted to the predaceous Hymenoptera, until the abstract of published records is as full and complete as it can be made. It is believed that the work will be finished early in 1907, and that no long interval need elapse between the two sections of the memoir.

The same argument does not apply to the First Part, which is in the main a presentation of new records, and does not profess to contain anything like a complete abstract of the published records scattered chiefly in the form of brief notes, though a voluminous literature. At the same time any published statements which have come to light are included; and many more will certainly be found in the systematic search for records of predaceous Hymenoptera. Any such additions to Part I will appear in the form of an Appendix at the end of Part II.

I desire to thank the Council for their courtesy in permitting, as an exceptional privilege, the inclusion of predaceous insects and their prey captured after the date at which the paper was read,—June 6th, 1906. All such additions will be immediately recognized by their dates. Owing to this concession many of the conclusions rest upon a far broader foundation than would otherwise have been possible.

It is hoped that this paper will be of some use to those who are interested in the problems of Economic Entomology rather than in the study of Insect natural history or bionomics for their own sake. With this object the popular names have been used whenever possible, and the classificatory position of the prey indicated. I have been much impressed with the imperative necessity for the accumulation on a very large scale of this kind of evidence, if trustworthy conclusions are to be reached—conclusions safe enough to become the justification for practical measures. It is not sufficient to know that an insect is predaceous, and that it is believed in a general way to attack particular species or groups of species. We need precise records and the careful preservation of material for critical examination in the future. Thus it will be found in numbers of cases that

the predaceous species frequently or even normally attack insects which are themselves predaceous or parasitic, in such instances tending towards the preservation rather than the destruction of insect life. It is unnecessary to quote instances when they will be found in numbers scattered through the following tabulated records; but I may allude to the amusing reciprocity exhibited by examples 268 and 293. In the former an Empid fly was devouring the Anthomyid fly, *Caricea tigrina*: in the latter *Caricea tigrina* was devouring an Empid!

In order to facilitate reference, all records in Part I of this memoir have been conspicuously numbered. In Part II, dealing with the predaceous Hymenoptera, the reference numbers will be confined to original records, published for the first time. The difference in method is due to the small proportion in Part I of examples previously published, as contrasted with their immense preponderance in Part II.

The study of the original records here brought forward and their comparison with the results obtained in the future, will be aided by a statement, made whenever possible, of the collection in which each example is to be found. The words, "In Hope Dep.," "In Brit. Mus.," etc., appearing beneath the name of the predaceous species implies that the prey as well as the captor exists in the collection indicated. A modified statement will make it clear when the captor alone or the prey alone is known to be in existence.

References to previous publication will in Part I be found under the name of the observer. For the sake of brevity the publications of the Entomological Society of London are indicated by no more than the abbreviation "Trans." or "Proc.," together with the year of publication and page.

In Part I the Orders to which the predaceous insects belong are treated merely in the order of the number of records. It will at once be recognized that evidence of importance has only been obtained in the Diptera of Part I and the Hymenoptera Aculeata of Part II.

I. DIPTERA.

The records in the first part of this memoir are set forth in a tabular form, beginning with the family which stands foremost among predaceous Diptera,—the *Asilidæ*.

A. Asilidæ and their Prey.

SPECIES OF ASILID.	SPECIES OF PREY.	LOCALITY AND DATE.	OBSERVER.
I. DASYPOGONINÆ.			
1. *Dioctria œlandica*, L., ♀. In Brit. Mus.	The Ichneumonid (*Ophioninæ*), *Campoplex leptogaster*, Holmgr., ♀.	Lyndhurst, New Forest. May 27, 1894.	J. W. Yerbury. Trans. 1902, p. 332.
2. *Dioctria œlandica*, L. ? Sex, specimens uncaptured.	A scorpion-fly, *Panorpa*, sp.	Lodiswell, S. Devon. May 24, 1896.	J. W. Yerbury.
3. *Dioctria œlandica*, L. ? Sex, specimens uncaptured.	A small moth with long antennæ, probably *Adela*, sp.	Lodiswell, S. Devon. May 24, 1896.	J. W. Yerbury.
4. *Dioctria œlandica*, L. ? Sex, specimens uncaptured.	A small sp. of the Hymenoptera Parasitica, probably a Braconid.	Lodiswell, S. Devon. May 25, 1896.	J. W. Yerbury.
5. *Dioctria œlandica*, L., ♀. In Hope Dep.	The Ichneumonid, *Cratichneumon annulator*, F., ♂.	Pamber Forest, near Basingstoke. May 30, 1903.	H. St. J. K. Donisthorpe.
6. *Dioctria atricapilla*, Mg., ♀. In Brit. Mus.	The Ichneumonid (*Ophioninæ*), *Meloboris* (*Limneria*) *rufiventris*, Grav., ♂.	Gravesend. June 4, 1893.	J. W. Yerbury. Trans. 1902, p. 333.
7. *Dioctria rufipes*, De G., ♀. In Brit. Mus.	The Tenthredinid (Sawfly), *Blennocampa assimilis*, Fln., ♀. Determined, in spite of condition, by Rev. F. D. Morice.	Ledbury. June 4, 1895.	J. W. Yerbury. Trans. 1902, p. 333 (prey erroneously called Ichneumon).
8. *Dioctria rufipes*, De G., ♂? In Hope Dep.	The Empid fly, *Empis pennipes*, L., ♀.	Cusop, Herefordshire. June 11, 1902.	J. W. Yerbury.
9. *Dioctria rufipes*, De G., ♀. In Hope Dep.	The Syrphid fly, *Sphegina clunipes*, Fln., ♀.	Cusop, Herefordshire. June 11, 1902.	J. W. Yerbury.

10. *Dioctria baumhaueri*, Mg., ♀. In Coll. G. C. Bignell.	The Ichneumonid (*Cryptinæ*), *Microcryptus galactinus*, Grav., ♂.	Bickleigh, Devon. June 24, 1882.	G. C. Bignell. Cf. Claude Morley "Ichneumons of Britain," ii, 1906, p. 40.
11. *Dasypogon* (*Selidopogon*) *diadema*, F., ♂. In Hope Dep.	A fly of the genus *Sarcophaga*.	Simplon Road, Brieg, Switzerland, 2450 ft. July 24, 1898.	E. B. Poulton. Trans. 1902, p. 334; 1904, p. 661.
x **12.** *Dasypogon* (*Selidopogon*) *diadema*, F., ♀. In Hope Dep.	The wasp, *Polistes gallica*, L., ☿.	Port Bou, Eastern Pyrenees, Spain. June 24, 1901.	E. B. Poulton.
13. *Dasypogon* (*Selidopogon*) *diadema*, F. ? Sex, specimen escaped. Prey in Hope Dep.	The wasp, *Polistes gallica*, L., ☿.	Port Bou, Eastern Pyrenees, Spain. June 24, 1901.	E. B. Poulton.
14. *Dasypogon diadema*, F. ? Sex, specimen untraced. Prey in Hope Dep.	The wasp, *Polistes gallica*, L., ☿.	Port Bou, Eastern Pyrenees, Spain. June 24, 1901.	A. H. Hamm.
15. *Dasypogon diadema*, F., ♀. In Hope Dep.	The Fossor (Sand-wasp), *Pompilus viaticus*, F., ♀.	Above Palace grounds, La Granja, Spain, about 4500 ft. July 20, 1902.	E. B. Poulton. Trans. 1904, p. 634, also p. 661.
16. *Dasypogon diadema*, F. ? Sex, specimen uncaptured. Prey in Hope Dep.	The Cetoniid (Rose-chafer), *Oxythyrea stictica*, L., ♀. Seized and abandoned.	La Granja, Spain, about 4000 ft. July 20, 1902.	E. B. Poulton.
17. *Dasypogon diadema*, F., ♀. In Hope Dep.	The Hive-bee, *Apis mellifica*, L., ☿.	La Granja, Spain, about 4000 ft. July 22, 1902.	Monsieur Chretien. Trans. 1902, p. 336; 1904, p. 660.

x 12. This and the other similarly marked specimens of *Dasypogon* (*Selidopogon*) *diadema* correspond to Loew's description of *D. melanopterus*. I have preferred to leave them among the *diadema* until the special distinction between the two forms is confirmed.

SPECIES OF ASILID.	SPECIS OF PREY.	LOCALITY AND DATE.	OBSERVER.
I. DASYPOGONINÆ (*continued*).			
18. *Dasypogon diadema*, F., ♀. In Hope Dep.	The Fossor (Sand-wasp), *Tiphia femorata*, F., ♂.	La Granja, Spain, about 4000 ft. July 22, 1902.	E. B Poulton. Trans. 1904, p. 633 (date erroneously given as July 23).
19. *Dasypogon diadema*, F., ♂. In Hope Dep.	The Glaphyrid (Lamellicorn) beetle, *Chasmatopterus pilosulus*, Illig., ♂.	La Granja, Spain, about 4000 ft. July 22, 1902.	E. B. Poulton.
20. *Dasypogon diadema*, F., ♂. In Hope Dep.	The Glaphyrid (Lamellicorn) beetle, *Chasmatopterus pilosulus*, Illig., ♀.	La Granja, Spain, about 4000 ft. July 22, 1902.	E. B. Poulton.
21. *Dasypogon diadema*, F., ♂. Asilid in Hope Dep.	The Glaphyrid (Lamellicorn) beetle, *Chasmatopterus pilosulus*, Illig., ♀. Specimen lost.	La Granja, Spain, about 4000 ft. July 22, 1902.	E. B. Poulton.
22. *Dasypogon diadema*, F., ♀; courted by ♂. In Hope Dep.	The Hive-bee, *Apis mellifica*, L., ☿.	La Granja, Spain, about 4000 ft. July 23, 1902.	E. B. Poulton. Trans. 1902, p. 336; 1904, p. 660.
23. *Dasypogon diadema*, F., ♀. In Hope Dep.	The Hive-bee, *Apis mellifica*, L., ☿.	La Granja, Spain, about 4000 ft. July 23, 1902.	E. B. Poulton.
24. *Dasypogon diadema*, F., ♂. In Hope Dep.	The Hive-bee, *Apis mellifica*, L., ☿.	La Granja, Spain, about 4000 ft. July 23, 1902.	E. B. Poulton.
25. *Dasypogon diadema*, F., ♀; courted by ♂. Specimens not captured. Prey in Hope Dep.	The Hive-bee, *Apis mellifica*, L., ☿.	La Granja, Spain, about 4000 ft. July 23, 1902.	E. B. Poulton.
26. *Dasypogon diadema*, F., ♀. In Hope Dep.	The bee, *Halictus malachurus*, Kirb., ♀.	La Granja, Spain, about 4000 ft. July 23, 1902.	E. B. Poulton. Trans. 1904, p. 651.

27. *Dasypogon diadema*, F., ♀. In Hope Dep.	The Ichneumonid, *Stenichneumon lacteator*, Grav., ♀; hitherto unrecorded from Spain.	La Granja, Spain, about 4000 ft. July 23, 1902.	E. B. Poulton.
28. *Dasypogon diadema*, F., ♂. In Hope Dep.	The Ichneumonid, *Pimpla examinator*, F., ♂.	La Granja, Spain, about 4000 ft. July 23, 1902.	E. B. Poulton.
29. *Dasypogon diadema*, F., ♂. Asilid in Hope Dep.	A small insect was captured on the wing and then thrown away, perhaps because the Asilid was disturbed.	La Granja, Spain, about 4000 ft. July 23, 1902.	E. B. Poulton.
30. *Dasypogon diadema*, F., ♀. In Hope Dep.	The Hive-bee, *Apis mellifica*, L., ☿.	La Granja, Spain, about 4000 ft. July 24, 1902.	E. B. Poulton. Trans. 1902, p. 336; 1904, p. 660.
31. *Dasypogon diadema*, F., ♀. In Hope Dep.	The Hive-bee, *Apis mellifica*, L., ☿.	La Granja, Spain, about 4000 ft. July 24, 1902.	E. B. Poulton.
32. *Dasypogon diadema*, F., ♀. Specimens uncaptured.	The Hive-bee, *Apis mellifica*, L., ☿.	La Granja, Spain, about 4000 ft. July 24, 1902.	E. B. Poulton.
33. *Dasypogon diadema*, F., ♀. Specimens uncaptured.	The Hive-bee, *Apis mellifica*, L., ☿.	La Granja, Spain, about 4000 ft. July 24, 1902.	E. B. Poulton.
34. *Dasypogon diadema*, F. Sex not observed, specimens uncaptured.	The Hive-bee, *Apis mellifica*, L., ☿.	La Granja, Spain, about 4000 ft. July 24, 1902.	E. B. Poulton.
35. *Dasypogon diadema*, F., ♀. In Hope Dep.	The ant, *Formica rufa*, L., race *pratensis*, De Geer, ♀, winged.	La Granja, Spain, about 4000 ft. July 24, 1902.	E. B. Poulton. Trans. 1904, p. 631.
36. *Dasypogon diadema*, F., ♀. In Hope Dep.	The Coreid bug, *Camptopus lateralis*, Germ., ♂.	La Granja, Spain, about 4000 ft. July 24, 1902.	E. B. Poulton.
37. *Dasypogon diadema*, F., ♀. In Hope Dep.	The Hive-bee, *Apis mellifica*, L., ☿.	La Granja, Spain, about 4000 ft. July 26, 1902.	E. B. Poulton. Trans. 1902, p. 336; 1904, p. 660.

SPECIES OF ASILID.	SPECIES OF PREY.	LOCALITY AND DATE.	OBSERVER.
I. DASYPOGONINÆ (*continued*).			
38. *Dasypogon diadema*, F., ♀; courted by ♂. In Hope Dep.	The bee, *Sphecodes gibbus* ,L., ♂.	La Granja, Spain, about 4000 ft. July 26, 1902.	E. B. Poulton. Trans. 1904, p. 643.
39. *Dasypogon diadema*, F., ♀. In Hope Dep.	The bee, *Halictus costulatus*, Kirb., ♂.	La Granja, Spain, about 4000 ft. July 26, 1902.	E. B. Poulton. Trans. 1904, p. 650.
40. *Dasypogon diadema*, F., ♀; courted by ♂. Specimens not captured, but ♀ observed to withdraw her proboscis from the prey and leave it upon a leaf. Prey in Hope Dep.	The Ichneumonid, *Pimpla* (*Itioplectis*) *pomorum*, Ratz., ♀; probably unrecorded from Spain.	La Granja, Spain, about 4000 ft. July 26, 1902.	E. B. Poulton.
41. *Dasypogon diadema*, F., ♀. In Hope Dep.	*Dasypogon diadema*, F., ♂; a small specimen.	La Granja, Spain, about 4000 ft. July 26, 1902.	E. B. Poulton.
x **42.** *Dasypogon diadema*, F., ♀. In Hope Dep.	The ant, *Camponotus cruentatus*, Ltr., ♀, winged.	El Escorial, Spain, about 3400 ft. July 28, 1902.	E. B. Poulton. Trans. 1904, p. 631.
***43.** *Dasypogon diadema*, F., ♂. In Hope Dep.	The ant, *Formica fusca*, L., ♀, wingless.	La Granja, Spain, about 7000 ft. July 24, 1904.	T. A. Chapman.
44. *Dasypogon diadema*, F., ♀. In Hope Dep.	The Hydrophilid beetle, *Sphæridium scarabæoides*, L.	La Granja, Spain, about 7000 ft. July 24, 1904.	T. A. Chapman.
x **45.** *Dasypogon diadema*, F., ♀. In Hope Dep.	The Coprid beetle (Dung-beetle), *Oniticellus flavipes*, F., ♀.	La Granja, Spain, about 7000 ft. July 24, 1904.	T. A. Chapman.

x 42, 45. See note on p. 331.
* 43. All the examples captured at a height of 7000 ft., viz. Nos. 43–48 and 50–54, were taken by Dr. Chapman upon La Peñalara, the mountain immediately behind La Granja.

46. *Dasypogon diadema*, F., ♀. In Hope Dep.	The Syrphid fly (Drone-fly), *Eristalis tenax*, L., ♀.	La Granja, Spain, about 7000 ft. July 24, 1904.	T. A. Chapman.
47. *Dasypogon diadema*, F., ♀. In Hope Dep.	The Syrphid fly (Drone-fly), *Eristalis tenax*, L., ♀.	La Granja, Spain, about 7000 ft. July 24, 1904.	T. A. Chapman.
48. *Dasypogon diadema*, F., ♂. In Hope Dep.	The Asilid fly, *Dysmachus*, nr. *trigonus*, Mg., but not this species, ♀.	La Granja, Spain, about 7000 ft. July 24, 1904.	T. A. Chapman.
49. *Dasypogon diadema*, F., ♀. In Hope Dep.	The Fossor (Sand-wasp), *Ammophila hirsuta*, Scop., ♂.	La Granja, Spain, about 5000 ft. July 25, 1904.	T. A. Chapman.
50. *Dasypogon diadema*, F., ♂. In Hope Dep.	The Fossor (Sand-wasp), *Pompilus unicolor*, Spin., ♂	La Granja, Spain, about 7000 ft. July 26, 1904.	T. A. Chapman.
51. *Dasypogon diadema*, F., ♀. In Hope Dep.	The ant, *Formica fusca*, L., ♂.	La Granja, Spain, about 7000 ft. July 26, 1904.	T. A. Chapman.
52. *Dasypogon diadema*, F., ♂. In Hope Dep.	A bee of the genus *Halictus*, unnamed in coll. E. Saunders, ♂.	La Granja, Spain, about 7000 ft. July 26, 1904.	T. A. Chapman.
53. *Dasypogon diadema*, F., ♀. In Hope Dep.	The ant, *Formica fusca*, L., ♂.	La Granja, Spain, about 7000 ft. July 27, 1904.	T. A. Chapman.
54. *Dasypogon diadema*, F., ♀. In Hope Dep.	The Humble-bee, *Bombus agrorum*, F., race, *pascuorum*, Scop., ♂.	La Granja, Spain, about 7000 ft. July 27, 1904.	T. A. Chapman.
*x****55.** *Dasypogon* (*Selidopogon*) *diadema*, F., ♂. In Hope Dep.	The Hive-bee, *Apis mellifica*, L., ☿.	Brañuelas, Leon, N.W. Spain, 3200 ft. July 11–15, 1906.	T. A. Chapman.
56. *Saropogon*? sp., considered by G. H. Verrall to be perhaps new, ? ♀. In Hope Dep.	The Glaphyrid (Lamellicorn) beetle, *Chasmatopterus pilosulus*, Illig., ♂.	Bejar, West Central Spain, 3300 ft. June–July, 1902.	T. A. Chapman.

x 55. See note on p. 331.

* 55. Mr. G. H. Verrall remarks that the wings are much broader than in *D.* (*S.*) *melanoptera* as he recognizes it.

SPECIES OF ASILID.	SPECIES OF PREY.	LOCALITY AND DATE.	OBSERVER.
I. DASYPOGONINÆ (*continued*).			
57. *Saropogon frontalis*, Lw., ♀. In Hope Dep.	An Anthomyid fly of the genus *Mydæa*, ♂. Species undeterminable through grease.	Pto. de Pajares, Spain, 4000 ft. July 21, 1904.	T. A. Chapman.
58. *Microstylum dux*, Wied., ♀ "its beak through the elytra of the *Cetonia*." Asilid in Brit. Mus.	The beetle (Rose-chafer), *Protætia mandarinea*, Weber. Specimen untraced in Brit. Mus.	Hong Kong. Asilid given to British Museum, 1861.	J. C. Bowring. Trans. 1902, p. 335.
59. *Microstylum dux*, Wied., ♀. This specimen and three ♀♀ of *Promachus* sp. in a paper with the *Cicada* and two ☿☿ of the *Vespa*. In Hope Dep.	Probable prey, the Cicada, *Rihana ochracea*, Walk., ♂, or the wasp, *Vespa cincta*, F., var. *affinis*, F., ☿.	Macao, S.E. China. July 18, 1905.	J. C. Kershaw.
60. *Microstylum dux*, Wied., ♂. In Hope Dep.	The Cicada, *Mogannia mandarinea*, Distant. Injured by mould.	Macao, S.E. China. May, 1906.	J. C. Kershaw.
61. *Microstylum apicale*, Wied., ♀. Asilid in Brit. Mus.	An Acridian (Grasshopper) untraced in Brit. Mus.	Nilavelli, Trinkomali, Ceylon. Nov. 16, 1890.	J. W. Yerbury. Trans. 1902, p. 332.
62. *Microstylum apicale*, Wied., sex unnoted. In Brit. Mus.	The Cicada, *Abroma nubifurca*, Walk. (*Tibicen nubifurca*, Stål).	Trinkomali, Ceylon. Nov., 1890.	J. W. Yerbury. Zoologist, 1900, p. 559; Trans. 1902, p. 332.
63. *Microstylum gulosum*, Lw., ♀. In Hope Dep.	The Melolonthid beetle, *Monochelus femoratus*, Burm., ♀.	Malvern, near Durban, Natal, 800 ft. Nov. 11, 1902.	G. A. K. Marshall.

64. *Microstylum gulosum*, Lw., ♀. In Hope Dep.	A Melolonthid beetle (Chafer) of the genus *Camenta*, ♀.	Malvern, near Durban, Natal, 800 ft. Nov. 11, 1902.	G. A. K. Marshall.
65. *Microstylum gulosum*, Lw., ♀. In Hope Dep.	The Asilid fly, *Promachus capreolus*, Lw., ♂.	Estcourt, Natal, 4000 ft. Nov., 1902.	G. A. K. Marshall.
66. *Isopogon brevirostris*, Mg., ♀. In Hope Dep.	The Braconid, *Meteorus obfuscatus*, Nees., ♀.	Barmouth, N. Wales. July 6, 1902.	J. W. Yerbury.
67. *Stenopogon ochripes*, Lw., ♂. In Hope Dep.	The Melyrid beetle, *Henicopus armatus*, Lucas, ♂.	Moncayo, about 40 miles W. of Saragossa, 4–5000 ft. July 12–24, 1903.	T. A. Chapman.
68. *Stenopogon*, sp. perhaps near *subaudus*, F., ♀. In Hope Dep.	A Melyrid beetle of the genus *Henicopus*, near *senex*, Rosenh., ♀.	Moncayo, about 40 miles W. of Saragossa, 4–5000 ft. July 12–24, 1903.	T. A. Chapman.
69. *Stenopogon inquinatus*, Lw., ? sex.	The Pentatomid bug, *Thyanta perditor*, F. (adult).	Pecos Canyon, New Mexico, 7300 ft.	T. D. A. Cockerell. Entomologist, 1905, p. 236.
70. *Ospriocerus abdominalis*, Say., ? sex.	The Cantharid beetle, *Cantharis biguttatus*, Lec.	Pecos, New Mexico.	T. D. A. Cockerell. Entomologist, 1905, p. 236.
71. *Scleropogon piceus*, v. Röd., ♂. In Brit. Mus.	The Danaine butterfly, *Tirumala limniace*, Cr., ♀.	Trinkomali. June 25, 1891.	J. W. Yerbury. Trans. 1902, p. 332, where Asilid stands as *S. ambryon*.
72. *Scleropogon piceus*, v. Röd., ♀. In Brit. Mus.	A ♀ of the same species of Asilid fly, —*S. piceus*.	Trinkomali. July 18, 1891.	J. W. Yerbury. Trans. 1902, p. 332.

SPECIES OF ASILID.	SPECIES OF PREY.	LOCALITY AND DATE.	OBSERVER.
I. DASYPOGONINÆ (*continued*).			
73. *Scleropogon piceus*, v. Röd., ♀. In Brit. Mus.	The Asilid fly, *Alcimus hospes*, Wied. A fragment.	Perriya Kulam, Trinkomali. Oct. 11, 1891.	J. W. Yerbury. Trans. 1902, p. 332. Date erroneously given Oct. 18, and prey undetermined.
74. *Damalina*, sp. nr. *myops*, F., ♂. In Hope Dep.	The Dammar-bee, *Melipona apicalis*, Sm., ☿.	Ataran Valley, L. Tenasserim, L. Burma. April 1898.	C. T. Bingham. Trans. 1902, p. 334.
75. *Damalina*, sp. probably *myops*, F., ♀. In Hope Dep.	The Dammar-bee, *Melipona vidua*, Lepel., ☿. The bee was captured close by its nest.	Maymyo, U. Burma, 3000 ft. Sept. 5, 1898.	C. T. Bingham.
76. *Lasiopogon cinctus*, F., ♀. In Hope Dep.	The Tipulid (Daddy-longlegs), *Pachyrrhina histrio*, F., ♂.	Porthcawl, S. Wales. May 11, 1903.	J. W. Yerbury.
77. *Lasiopogon cinctus*, F., ♀. The Asilid, still holding its prey, was being eaten by a spider, an immature *Lycosa*, sp ?. In Hope Dep.	The Tipulid (Daddy-longlegs), *Pachyrrhina histrio*, F., ♂.	Porthcawl, S. Wales. May 11, 1903.	J. W. Yerbury.
78. *Lasiopogon cinctus*, F., ♀. In Brit. Mus.	The Tipulid (Daddy-longlegs), *Pachyrrhina histrio*, F., ♂.	Porthcawl, S. Wales. May 19, 1903.	J. W. Yerbury.
II. LAPHRINÆ.			
***79**. *Hoplistomerus serripes*, F., ♀. In Hope Dep.	The Aphodiid beetle (Dung-beetle), *Aphodius marginicollis*, Harold.	Isipingo, S. of Durban, Natal. Sea level. Dec. 28, 1902.	F. Muir.

* 79. Following Col. Yerbury's advice I have adhered to the old divisional line between the *Dasypogoninæ* and *Laphrinæ*, and have not followed Hermann in placing *Hoplistomerus* in the former subfamily.

80. *Laxenecera albicincta*, Lw., ♀. In Hope Dep.	The Fossor (Sand-wasp), *Ammophila ferrugineipes*, Lepel., ♂.	Salisbury, Mashonaland, 5000 ft. March, 1903.	G. A. K. Marshall.
81. *Laxenecera albicincta*, Lw., ♂. In Hope Dep.	The Dammar-bee, *Melipona*, sp., ☿, closely allied to *M. beccarii*, Grib.	Salisbury, Mashonaland, 5000 ft. Jan. 22, 1905.	G. A. K. Marshall.
82. *Laxenecera*, sp., probably *zonata*, Lw., ♀. In Hope Dep.	The Fossor (Sand-wasp), *Ammophila ferrugineipes*, Lepel., ♂.	Salisbury, Mashonaland, 5000 ft. 1899.	G. A. K. Marshall.
83. *Laxenecera flavibarbus*, Macq., ♀. In Hope Dep.	The bee, *Apis florea*, F., ☿.	Probably Poona. Probably about 1888.	T. B. Fry. Trans. 1902, p. 335.
***84.** *Hyperechia xylocopiformis*, Walk., ♀ In Hope Dep.	The Xylocopid bee (Carpenter-bee), *Xylocopa auripennis*, Lepel., ♂.	Bangalore. May, 1901.	T. D. Broughton.
85. *Hyperechia xylocopiformis*, Walk. Fig. suggests a ♀.	Observed circling round the Xylocopid bee, *Xylocopa fenestrata*, F.	Ceylon.	E. E. Green. Proc. 1904, p. xxxix and p. lxxxvii.
86. *Laphria gibbosa*, L., ♂ and ♀ *in cop.*: the lower insect, the ♀, with prey. In Hope Dep.	The beetle, *Buprestis* (*Ancylocheira*) *flavomaculata*, F. The proboscis was thrust through the cephalo-thoracic articulation.	Tragacete, Albarracin Mountains, Spain. July 18–26, 1901.	T. A. Chapman. Trans. 1902, p. 335; Ent. Record, 1902, p. 72.
87. *Laphria gibbosa*, L., ? sex: specimens not available.	A beetle different from the above.	Tragacete, Albarracin Mountains, Spain. July 18–26, 1901.	T. A. Chapman. Trans. 1902, p. 335; Ent. Record, 1902, p. 72.

* 84. The observer noted that one of the insects was dead and in the clasp of the other. There is of course no doubt that the *Xylocopa* was the victim.

SPECIES OF ASILID.	SPECIES OF PREY.	LOCALITY AND DATE.	OBSERVER.
II. LAPHRINÆ (*continued*).			
88. *Laphria flava*, L., ♀. In Hope Dep.	The ant, *Formica rufa*, L., ♂.	La Granja, Spain, 5000 ft. July 30, 1904.	T. A. Chapman.
89. *Laphria*, sp., ? *gilva*, L., ♂. G. H. Verrall remarks "unusually broad for this sp., and red extends further than usual towards base of abdomen." In Hope Dep.	A Conopid fly (*Myopinæ*) of the genus *Myopa*, ♀. Condition prevents determination.	Casayo, S.E. of El Barco, N.W. Spain, 3500 ft. July 2–9, 1906.	T. A. Chapman.
90. *Maira*, sp., ♀. In Brit. Mus.	The Syrphid fly, *Eumerus*, sp., ♂, probably *splendens*, Wied. Headless and in bad condition.	Foul Point, Trinkomali. Oct. 26, 1890.	J. W. Yerbury. Trans. 1902, p. 332.
91. *Lamyra*, sp., probably *gulo*, Lw., ♀, but differs somewhat from Loew's description. In Hope Dep.	The wasp (Diploptera), *Belenogaster macilentus*, De Sauss., ☿. The wasp was itself eating a caterpillar, a part of which is still held in the mandibles.	Mazoe, Mashonaland, 4700 ft. Dec. 27, 1905.	G. A. K. Marshall.
92. *Lamyra*, sp., probably *gulo*, Lw., ♀. In Hope Dep.	An Asilid fly (*Dasypogoninæ*) of the genus *Leptogaster*. The *Lamyra* had seized a pair *in coitu*, but it is uncertain which individual was being devoured.	Petauke, East Loangwa Distr., N.E. Rhodesia, 2400 ft. Feb. 1, 1905.	S. A. Neave.
93. *Proagonistes*, sp., probably *præceps*, Walk., ♀. In Hope Dep.	The bee, *Halictus*, sp., ♀, close to *H. torridus*, Sm., but smaller.	Chirinda Forest, Gazaland, S.E. Rhodesia, 4500 ft. Dec. 12, 1901.	G. A. K. Marshall. Trans. 1902, p. 334.

III. ASILINÆ.			
94. *Craspedia*, n. sp., ♂. In Brit. Mus.	The Xylocopid bee (Carpenter-bee), *Xylocopa bryorum*, F., ♀.	Townsville, Queensland. Acquired by B. M. 1904.	F. P. Dodd.
95. *Promachus æqualis*, Lw., ♀ : ?= *caffra*, Macq., = *fasciatus*, F. In Hope Dep.	A Heteromerous beetle, *Lagria*, sp.	Salisbury, Mashonaland, 5000 ft. Jan. 26, 1902.	G. A. K. Marshall. Trans. 1902, p. 334.
96. *Promachus æqualis*, Lw., ♀. In Hope Dep.	The ♂ of its own species, *P. æqualis*.	Salisbury, Mashonaland, 5000 ft. Dec., 1902.	G. A. K. Marshall.
97. *Promachus æqualis*, Lw., ♀. In Hope Dep.	The Coprid beetle (Dung-beetle), *Onthophagus obtusicornis*, Fåhr., ♂.	Salisbury, Mashonaland, 5000 ft. March 13, 1904.	G. A. K. Marshall.
98. *Promachus æqualis*, Lw., ♀. In Hope Dep.	The Coprid beetle (Dung-beetle), *Delopleurus pullus*, Boh., teste Péringuey. Mr. G. J. Arrow considers it doubtful whether this is the *pullus* of Boheman.	Salisbury, Mashonaland, 5000 ft. Dec. 26, 1904.	G. A. K. Marshall.
99. *Promachus æqualis*, Lw., ♀. In Hope Dep.	The Melolonthid beetle (Chafer), *Serica*, sp.	Salisbury, Mashonaland, 5000 ft. Jan. 1, 1905.	G. A. K. Marshall.
100. *Promachus æqualis*, Lw., ♂. In Hope Dep.	The winged Termite (so-called White Ant), *Termes bellicosus*, Smeathm., or a sp. close to it.	Salisbury, Mashonaland, 5000 ft. Feb. 5, 1905.	G. A. K. Marshall.
101. *Promachus æqualis*, Lw., ♀. In Hope Dep.	The winged Termite (so-called White Ant), *Termes bellicosus*, Smeathm., or a sp. close to it.	Salisbury, Mashonaland, 5000 ft. Feb. 5, 1905.	G. A. K. Marshall.

SPECIES OF ASILID.	SPECIES OF PREY.	LOCALITY AND DATE.	OBSERVER.
III. ASILINÆ (*continued*).			
102. *Promachus*, sp. A., ♀. In Hope Dep.	The Odonate (Dragonfly), *Trithemis*, sp. ♂, probably an immature *T. dorsalis*, Ramb.	Salisbury, Mashonaland, 5000 ft. Oct. 6, 1901.	G. A. K. Marshall. Trans. 1902, p. 334, where Asilid stands as perhaps *vagator*.
103. *Promachus*, sp. A., ♀. In Hope Dep.	The ♂ of the same sp. of Asilid fly, *Promachus*, sp. A.	Salisbury, Mashonaland, 5000 ft. Nov. 12, 1905.	G. A. K. Marshall.
104. *Promachus*, sp. A., ♀. In Hope Dep.	A smaller Asilid fly (*Dasypogoninæ*), *Laparus squalidus*, Lw., ♀.	Salisbury, Mashonaland, 5000 ft. Nov. 12, 1905.	G. A. K. Marshall.
105. *Promachus*, sp. inc., nr. *guineensis*, Wied., ♀. In Hope Dep.	The honey-bee, *Apis mellifica*, L., ☿, African form of.	Umvumvumvu River, Gazaland. Oct. 24, 1905.	G. A. K. Marshall.
106. *Promachus*, sp. nr. *fulvipes*, Macq., ♀. In Hope Dep.	The Ichneumonid (*Pimplinæ*), *Leptobatopsis*, sp. ?, ♀.	Chirinda Forest, Gazaland, S.E. Rhodesia, 4500 ft. Oct. 17, 1905.	G. A. K. Marshall.
107. *Promachus vagator*, Wied., ♀. In Hope Dep.	The ♂ of a much smaller Asilid fly (*Dasypogoninæ*) of the genus *Neolaparus* (*Laparus*), probably *N. gracilipes*, Lw.	Salisbury, Mashonaland, 5000 ft. Nov. 19, 1905.	G. A. K. Marshall.
108. *Promachus*, sp. ? *scalaris*, Lw., ♂. In Hope Dep.	The Fossor (Sand-wasp), *Tachytes*, sp.	Salisbury, Mashonaland, 5000 ft. Oct. 18, 1903.	G. A. K. Marshall.
109. *Promachus*, sp. ? *scalaris*, Lw., ♀. In Hope Dep.	A smaller Asilid fly of the same genus, viz. *Promachus capreolus*, Lw., ♂.	Salisbury, Mashonaland, 5000 ft. Dec. 26, 1904.	G. A. K. Marshall.

110. *Promachus capreolus*, Lw., ♀. In Hope Dep.	The Coreid bug, *Nariscus cincti-ventris*, Germ.	Estcourt, Natal, 4000 ft. Nov., 1902.	G. A. K. Marshall.
111. *Promachus capreolus*, Lw., ♂. In Hope Dep.	A small *Cicada* of uncertain genus and species. Abdomen fragmentary.	Estcourt, Natal, 4000 ft. Nov., 1902.	G. A. K. Marshall.
112. *Promachus capreolus*, Lw., ♀. In Hope Dep.	A ♀ Tabanid fly (Horse-fly) of the genus *Hæmatopota*; near *H. brunnipennis*, Ric.	Salisbury, Mashonaland, 5000 ft. Jan. 1, 1905.	G. A. K. Marshall.
113. *Promachus*, ? sp. (without antennæ), ♀. In Hope Dep.	A fly of the genus *Sarcophaga*, ♀, much greased.	Malvern, near Durban, Natal, 7–800 ft. Jan. 13, 1903.	C. N. Barker.
114. *Promachus sokotræ*, Ric., ♂. In Brit. Mus.	The small *Cicada*, *Melampsalta* (*Cicadetta*) *omar*, Kirk., ♂.	Adho Dimellus, Socotra. Feb. 15, 1899.	W. R. Ogilvie-Grant. Zoologist, 1900, p. 559; Trans. 1902, p. 334. Nat. Hist. Sokotra, etc. Liverpool, 1903, H. O. Forbes, pp. 363, 381.
115. *Promachus maculatus*, F., ? sex. Specimens untraced in Brit. Mus.	The Odonate (Dragonfly), *Brachythemis contaminata*, F.	Trinkomali, Ceylon. 1890–91. Col. Yerbury now thinks the probable data are Kanthalai: Nov. 15, 1891.	J. W. Yerbury. Journ. Linn. Soc. Zool., V., 24, p. 551; Trans. 1902, p. 332.
116. *Promachus*, sp. nr. *flavibarbus*, Macq., ♀: 35 mm. across wings. In Brit. Mus.	The Dragonfly, *Rhyothemis phyllis* Sulz.: 78 mm. across wings.	Domdami Valley, Martaban, U. Tenasserim. Aug. 27, 1893.	C. T. Bingham. Trans. 1902, p. 334.

SPECIES OF ASILID.	SPECIES OF PREY.	LOCALITY AND DATE.	OBSERVER.
III. ASILINÆ (*continued*).			
117. *Promachus*, sp. ?*testaceipes*, Macq.: 3 ♀♀ of this very large species, and one ♀ of *Microstylum dux*, Wied., in a paper with the *Cicada* and 2 ☿☿ of the *Vespa*. In Hope Dep.	The wasp, *Vespa cincta*, F., var. *affinis*, F., ☿; and perhaps the Cicada, *Rihana ochracea*, Walk., ♂.	Macao, S.E. China. July 18, 1905.	J. C. Kershaw.
118. *Promachus anicius*, Walk., ♀. In Hope Dep.	The Cicada, *Mogannia nasalis*, White. Injured by mould.	Macao, S.E. China. May, 1906.	J. C. Kershaw.
119. *Promachus anicius*, Walk., ♀. In Hope Dep.	The Ichneumonid, *Chrysopimpla ornatipes*, Cam., ♂.	Macao, S.E. China. May, 1906.	J. C. Kershaw.
120. *Promachus anicius*, Walk., ♀. In Hope Dep.	The winged ant, *Camponotus rufoglaucus*, Jerd., ♀.	Macao, S.E. China. May, 1906.	J. C. Kershaw.
121. *Promachus anicius*, Walk., ♀. In Hope Dep.	A Rutelid beetle, of the genus *Anomala*, nr. *idiocnema*, Burm., ♂.	Macao, S.E. China. May, 1906.	J. C. Kershaw.
122. *Philodicus gracilis*, V. d. W., ♂. In Hope Dep.	The Lycænid butterfly (Blue), *Zizera gaika*, Trim., ♂.	Lahej, Aden. March 6, 1895.	J. W. Yerbury. Trans. 1899, p. 92, Pl. III. f. 5; 1902, p. 333.
123. ?*Philodicus*, sp., ♀. In Brit. Mus.	A large ♂ Tachinid fly in bad condition, probably *Blepharipoda zebrina*, Walk.	Perivipancheram, Trinkomali, Ceylon. April 21, 1891.	J. W. Yerbury. Trans. 1902, p. 332, where prey is unnamed.

124. *Alcimus longurio*, Lw., ♀. In Hope Dep.	The Lycænid butterfly, *Myrina dermaptera*, Wallengr., ♀.	Durban, Natal. Jan. 21, 1903.	F. Muir.
125. *Alcimus longurio*, Lw., ♀. In Hope Dep.	The Lymantrid moth, *Aroa discalis*, Walk., ♂.	Malvern, nr. Durban, Natal, 7–800 ft. Feb. 5, 1903.	C. N. Barker.
126. *Alcimus longurio*, Lw., ♂. In Hope Dep.	The Noctuid moth, *Chalciope hyppasia*, Cr., ♀.	Durban and neighbourhood, Natal. 1902–3.	F. Muir.
127. *Alcimus longurio*, Lw., ♀. In Hope Dep.	The Pierine butterfly (White), *Pinacopteryx pigea*, Boisd., ♀.	Durban and neighbourhood, Natal. 1902–3.	F. Muir.
128. *Alcimus stenurus*, Lw., ♀. In Hope Dep.	The Lycænid butterfly (Blue), *Polyommatus* (*Lampides*) *bœtica*, L., ♂.	Umtali, Mashonaland, 3700 ft. Dec. 29, 1900.	G. A. K. Marshall. Trans. 1902, p. 333.
***129.** *Alcimus stenurus*, Lw., ♀. In Hope Dep.	The Pierine butterfly, *Terias brigitta*, Cr., ♀.	Taveta, British East Africa, about 2500 ft. Nov. 2, 1905.	Rev. K. St. A. Rogers.
130. *Alcimus stenurus*, Lw., ♀. In Hope Dep.	The Pierine butterfly, *Catopsilia florella*, F., ♀.	Mazoe, Mashonaland, 4000 ft. Dec. 25, 1905.	G. A. K. Marshall.
131. *Alcimus alamanus*, Walk. = *perlongus*, Walk. (apud Schiner et Loew.), ♀. In Hope Dep.	The widely distributed Pyralid moth, *Noorda fessalis*, Swinh.	Salisbury, Mashonaland, 5000 ft. Oct. 25, 1903.	G. A. K. Marshall.
132. *Alcimus alamanus*, Walk., ♂. In Hope Dep.	The Acridian (Grasshopper), *Chirista*, sp. n., to be described shortly by Señor Bolivar.	Salisbury, Mashonaland, 5000 ft. Nov. 28, 1903.	G. A. K. Marshall.

* 129. The Rev. K. St. Aubyn Rogers probably refers to this species in the following extract from one of his letters, written from Taveta, July 5, 1905:—"I have several times observed a butterfly in the clutches of a predaceous fly which seems absolutely indifferent to protection afforded by unpalatable species, as I have seen it devouring *L. chrysippus*.'

SPECIES OF ASILID.	SPECIES OF PREY.	LOCALITY AND DATE.	OBSERVER.
III. ASILINÆ (*continued*).			
133. *Alcimus alamanus*, Walk., ♀. In Hope Dep.	The Acridian (Grasshopper), *Pseudo-arcyptera*, n. sp., ♀, to be described by Señor Bolivar.	Salisbury, Mashonaland, 5000 ft. Dec., 1903.	G. A. K. Marshall.
134. *Alcimus alamanus*, Walk., ♀. In Hope Dep.	The Lycænid butterfly, *Catochrysops malathana*, Boisd., = *asopus*, Hopff., ♀.	Salisbury, Mashonaland, 5000 ft. Dec. 10, 1904.	G. A. K. Marshall.
135. *Alcimus alamanus*, Walk., ♀. In Hope Dep.	The Acridian (Grasshopper), *Tmetonota abrupta*, Walk., = *rugosa*, Stål, ♀.	Salisbury, Mashonaland, 5000 ft. Nov. 9, 1905.	G. A. K. Marshall.
136. *Alcimus alamanus*, Walk., ♀. Specimen much greased. In Hope Dep.	An Acridian (Grasshopper), of the genus *Acrotylus*, ♀.	Salisbury, Mashonaland, 5000 ft. Feb. 11, 1906.	G. A. K. Marshall.
137. *Alcimus alamanus*, Walk., ♀. In Hope Dep.	The Lycænid butterfly (Blue), *Azanus moriqua*, Wallengr., ♀.	Petauke, E. Loangwa District, N.E. Rhodesia, 2400 ft. Nov. 20, 1904.	S. A. Neave.
* **138**. *Alcimus alamanus*, Walk., = *perlongus*, Walk., ♂. In Hope Dep.	The Nymphaline butterfly, *Hypolimnas misippus*, L. ♀.	Petauke, E. Loangwa District, N.E. Rhodesia, 2400 ft. Jan. 24, 1905.	S. A. Neave.

* 138. Mr. S. A. Neave also gives me the following notes upon an Asilid almost certainly of this genus, inasmuch as the elongate body was specially noticed and probably of this species. In the same month in which the above capture was made, January 1905, an Asilid was observed devouring the Pierine butterfly, *Catopsilia florella*, F. On the same spot of ground 7–8 dead butterflies of this species were then seen lying about as if they had been sucked dry and abandoned by the same flies. These observations were made in a small damp area beside a stream, below the station of Petauke. *Asilidæ* were most abundant in N.E. Rhodesia in December, January, and February.

139. *Apoclea femoralis*, Wied., ♀. Asilid in Hope Dep.	The Pierine butterfly (White), *Synchloë glauconome*, Klug. Specimen not taken.	Huswah, Aden. April 14, 1895.	J. W. Yerbury. Trans. 1899, p. 93; 1902, p. 333.
140. *Apoclea femoralis*, Wied., ♀ in bad condition. *Dasythrix*, sp. and an indeterminable sp. of *Asilinæ* both in very poor condition were in the box. It is probable that the *Apoclea* was the captor. In Hope Dep.	The Pierine butterfly, *Teracolus evarne*, Klug, ♂.	Port Sudan, 40 miles N. of Suakin. Jan., 1905.	T. Bainbrigge Fletcher.
141. *Philonicus albiceps*, Mg., ♀. In Brit. Mus.	A fly (*Muscinæ* restricted) of the genus *Lucilia* or *Euphoria*, probably *E. cornicina*, F., but specimen headless.	Dooks, near Glenbeigh, Kerry, Ireland. Aug. 15, 1901.	J. W. Yerbury.
142. *Philonicus albiceps*, Mg., ♀. In Hope Dep.	The Anthomyid fly (*Mydæinæ*), *Hyetodesia signata*, Mg., ♂.	Barmouth, N. Wales. July 7, 1902.	J. W. Yerbury.
143. *Philonicus albiceps*, Mg., ♂. Asilid in Coll. G. H. Verrall. Prey in Hope Dep.	The Anthomyid fly (*Cœnosinæ*), *Fucellia maritima*, Hal., ♀.	Studland, Dorset. Aug. 22, 1906.	J. E. Collin.
144. *Philonicus albiceps*, Mg., ♀. In Coll. C. Morley.	The Syrphid fly, *Syrphus ribesii*, L.	Brandon, Suffolk. Asilid at rest beneath *Erodium cicutarium*. Aug. 26, 1906.	Claude Morley.
145. *Philonicus*, sp., ♀. In Brit. Mus.	The fly (*Dexinæ*), *Thoracites abdominalis*, F., ♂.	Mahagany, Trinkomali, Ceylon. Nov. 30, 1890.	J. W. Yerbury. Trans. 1902, p. 332.

SPECIES OF ASILID.	SPECIES OF PREY.	LOCALITY AND DATE.	OBSERVER.
III. ASILINÆ (*continued*).			
146. *Philonicus*, sp. A., ♂. In Hope Dep.	A Tineid moth placed by J. H. Durrant in the genus *Sematocera*, or in a new genus allied to it.	Salisbury, Mashonaland, 5000 ft. Dec. 14, 1902.	G. A. K. Marshall.
147. *Philonicus*, sp. A., ♀. In Hope Dep.	The fly (*Sarcophaginæ*), *Sarcophaga* sp., ♂.	Salisbury, Mashonaland, 5000 ft. Nov. 1903.	G. A. K. Marshall.
148. *Pamponerus germanicus*, L., ♀. In Hope Dep.	The Melolonthid beetle (Chafer), *Hoplia philanthus*, Füss., ♂.	Barmouth, N. Wales. June 27, 1902.	J. W. Yerbury.
149. *Asilus crabroniformis*, L., ♀. In Hope Dep.	The Acridian (Grasshopper), *Stenobothrus viridulus*, L., ♀	New Forest, Hampshire. Aug. 22, 1902.	W. J. Lucas.
150. *Asilus crabroniformis*, L., ? sex, specimen uncaptured. Prey in Hope Dep.	The Galerucid beetle, *Sermyla halensis*, L.	Burley, New Forest, Hampshire. Aug. 18, 1903.	E. B. Poulton.
151. *Asilus crabroniformis*, L., ♀. In Hope Dep.	The fly (*Muscinæ*, restricted), *Lucilia cæsar*, L., ♂.	Torcross, S. Devon. Aug. 17, 1903.	J. W. Yerbury.
152. *Asilus crabroniformis*, L., ? sex, specimens uncaptured.	The fly (*Sarcophaginæ*), *Sarcophaga carnaria*, L.	Canford Common, near Poole. Aug. 13, 1904.	G. H. Verrall.
153. *Asilus crabroniformis*, L., ? sex, specimens uncaptured.	The Syrphid fly (*Milesinæ*), *Sericomyia borealis*, Fln.	Canford Common, near Poole. Aug. 13, 1904.	J. E. Collin.
154. *Asilus crabroniformis*, L., ? sex, specimens uncaptured.	A much smaller Asilid fly, probably *Machimus atricapillus*, Fln.	Walkham Valley, nr. Tavistock, S. Devon. 1889.	J. W. Yerbury.

155. *Asilus crabroniformis*, L., ♀. In Hope Dep.	The Acridian (Grasshopper), *Gomphocerus maculatus*, Thunb., ♂.	Corfe Castle, Dorset. Sept. 2, 1906.	J. W. Yerbury.
156. *Asilus crabroniformis*, L., ? sex, Asilid uncaptured. Prey in Hope Dep.	The Acridian (Grasshopper), *Mecostethus grossus*, L., ♀.	New Forest, Hampshire. Sept. 2, 1906.	W. J. Lucas.
157. *Lophonotus*, sp., ? *angustibarbus*, Lw., ♂ : 38·0 mm. across wings. In Hope Dep.	The Odonate (Dragonfly), *Trithemis arteriosa*, Burm., ♂ : 47 mm. across wings.	Salisbury, Mashonaland, 5000 ft. May 5, 1901.	G. A. K. Marshall. Trans. 1902, p. 333, where Asilid stands as ? *suillus*.
158. *Lophonotus*, sp., ? *angusti barbus*, Lw., ♀. In Hope Dep.	The Melolonthid (Lamellicorn) beetle, *Heterochelus*, sp., ♂.	Salisbury, Mashonaland, 5000 ft. April 12, 1903.	G. A. K. Marshall.
159. *Lophonotus*, sp., ? *angustibarbus*, Lw., ♀. In Hope Dep.	The Fossor (Sand-wasp), *Notogonia*, sp. ? new, ♂ : allied to the W. African *N. palumbula*, Kohl, and *N. thysanomera*, Kohl, but distinct.	Salisbury, Mashonaland, 5000 ft. April 12, 1903.	G. A. K. Marshall.
160. *Lophonotus*, sp. probably *suillus*, F., according to Loew's description, ♀. In Brit. Mus.	A ♀ Geometrid moth of the genus *Tephrina*, unnamed in Brit. Mus.	Piet Retief, Transvaal, 4100 ft. Aug. 30, 1903.	R. Crawshay.
161. *Lophonotus suillus*, F., according to Loew's description, ♀. In Hope Dep.	The Fossor (Sand-wasp), *Pseudagenia*, sp. nov., ♂.	Salisbury, Mashonaland, 5000 ft. April, 1904.	G. A. K. Marshall.
162. *Lophonotus suillus*, F., according to Loew's description, ♂. In Hope Dep.	A Chalcidid of the genus *Eucharis*, ♂.	Salisbury, Mashonaland, 5000 ft. April 16, 1905.	G. A. K. Marshall.

SPECIES OF ASILID.	SPECIES OF PREY.	LOCALITY AND DATE.	OBSERVER.
III. ASILINÆ (*continued*).			
163. *Dysmachus trigonus*, Mg., ♀. In Hope Dep.	The Stratiomyid fly (*Sarginæ*), *Chloromyia formosa*, Scop., ♀.	Barmouth, N. Wales. June 25, 1902.	J. W. Yerbury.
164. *Dysmachus trigonus*, Mg., ♂. In Hope Dep.	The Anthomyid fly, *Mydæa urbana*, Mg., ♂.	St. Brelade, 1–2 m. S.W. of St. Aubin, Jersey. June, 1903.	L. D. Saunders.
165. *Dysmachus trigonus*, Mg., ♀. In Hope Dep.	An Empid fly of the genus *Hilara*, ♀. G. H. Verrall finds condition too poor for a safe determination.	Tubney, near Abingdon, Berks. July 10, 1904.	A. H. Hamm.
166. *Dysmachus trigonus*, Mg., ♀. In Hope Dep.	The Crambid moth (Grass-moth), *Crambus pratellus*, Clk., ♀.	Tubney, near Abingdon. June 26, 1905.	J. Collins.
167. *Dysmachus trigonus*, Mg., ♀. In Hope Dep.	The Ichneumon (*Ophioninæ*), *Angitia fenestralis*, Holmgr., ♀.	Sandhills, Deal. Aug. 1, 1905.	A. H. Hamm.
168. *Dysmachus trigonus*, Mg., ♂. In Hope Dep.	The Coprid beetle (Dung-beetle), *Onthophagus fracticornis*, Preyss., ♀.	Sandhills, Deal. Aug. 6, 1905.	A. H. Hamm.
***169**. *Dysmachus*, sp., probably *setiger*, Lw., heretofore only known from the Levant, ♀. In Hope Dep.	The Melolonthid beetle (Chafer), *Rhizotrogus*, sp., ? *sainzi*, Graells, ♂.	Near Summit of Peñalara, La Granja, Spain, 7500 ft. July 25, 1902.	E. B. Poulton.
170. *Dysmachus*, sp., probably *setiger*, Lw., heretofore only known from the Levant, ♀. In Hope Dep.	The Melolonthid beetle (Chafer), *Rhizotrogus*, sp., ? *sainzi*, Graells, ♂.	Near Summit of Peñalara, La Granja, Spain, 7500 ft. July 25, 1902.	E. B. Poulton.

* 169–174. All the Spanish species of *Dysmachus* in this list, including also the prey of No. 48, are closely allied to the British *D. trigonus*, but are somewhat larger than that species. Accurate specific determinations or description of new forms will require far more material. See note to p. 357.

171. *Dysmachus*, sp., probably *setiger*, Lw., heretofore only known from the Levant, ♂. In Hope Dep.	The ant, *Myrmecocystus*, sp., ? *albicans*, Rog., ♀, winged.	Near Summit of Peñalara, La Granja, Spain, 7500 ft. July 25, 1902.	E. B. Poulton. Trans. 1904, p. 631.
172. *Dysmachus*, sp., considered by J. W. Yerbury to be perhaps *atripes*, Lw., ♀. Captured with two ♀ ♀ above and selecting the same prey. In Hope Dep.	The Melolonthid beetle (Chafer), *Rhizotrogus*, sp., ? *sainzi*, Graells, ♂.	Near Summit of Peñalara, La Granja, Spain, 7500 ft. July 25, 1902.	E. B. Poulton.
173. *Dysmachus*, sp., probably *spurius*, Lw., ♀. In Hope Dep.	The Geometrid moth, *Aspilates ochrearia*, Rossl., = *citraria*, Hb., ♂.	Algeciras, Spain. April, 1905.	Rev. F. D. Morice.
174. *Dysmachus*, sp., ♂. In Hope Dep.	The Crambid moth, *Crambus craterellus*, Scop., prob. ♂.	Moncayo, W. of Saragossa, Spain, 4–5000 ft. July 12–24, 1903.	T. A. Chapman.
175. *Eutolmus apicatus*, Lw., ♂ and ♀ *in cop.*, the lower insect, probably ♀, with prey. In Hope Dep.	A ♂ Anthomyid fly of the genus *Mydæa*, probably either *M. urbana* or *pagana*; greased.	Montserrat, near Barcelona, about 4000 ft. July 15, 1901.	E. B. Poulton. Trans. 1902, p. 334. Identification of Asilid now confirmed by G. H. Verrall.
176. ? *Eutolmus*, sp., ♀. Asilid in Hope Dep.	The Lycænid butterfly (Blue), *Catochrysops contracta*, Butl. Specimen not taken.	Disa, Bombay Presidency. Oct., 1899.	G. C. Nurse. Trans. 1902, p. 335, where Asilid stands as *Neoitamus griseus*.
177. Brown ♀ Asilid, probably *Machimus chrysitis*, Mg., Asilid uncaptured. Prey in Hope Dep.	The Acridian (Grasshopper), *Stenobothrus* (*Stauroderus*) *vagans*, Fieb., ♀.	La Granja, Spain, about 4000 ft. July 20, 1902.	E. B. Poulton.

SPECIES OF ASILID.	SPECIES OF PREY.	LOCALITY AND DATE.	OBSERVER.
III. ASILINÆ (*continued*).			
178. *Machimus chrysitis*, Mg., ♂. G. H. Verrall remarks that the femora are not much reddened above. Asilid in Hope Dep.	The Glaphyrid (Lamellicorn) beetle, *Chasmatopterus pilosulus*, Illig., ♀: specimen lost.	La Granja, Spain, about 4000 ft. July 22, 1902.	E. B. Poulton.
179. *Machimus chrysitis*, Mg., ♂. In Hope Dep.	The Tabanid fly (Horse-fly), *Pangonia*, sp., ? *micans*, Mg., ♀.	La Granja, Spain, about 4000 ft. July 22, 1902.	E. B. Poulton.
180. Brown Asilid, probably *Machimus chrysitis*, Mg., ? sex: uncaptured. Prey in Hope Dep.	The Asilid fly, *Dasypogon diadema*, F., ♂.	La Granja, Spain, about 4000 ft. July 22, 1902.	E. B. Poulton.
181. Brown Asilid, probably *Machimus chrysitis*, Mg., ? sex: uncaptured. Prey in Hope Dep.	The Coprid beetle (Dung-beetle), *Onthophagus fracticornis*, F., ♀.	La Granja, Spain, about 4000 ft. July 22, 1902.	E. B. Poulton.
182. *Machimus chrysitis*, Mg., ♂. See G. H. Verrall's remarks on the fourth specimen before this, No. 178. In Hope Dep.	The Lygæid bug, *Emblethis arenarius*, L.	La Granja, Spain, about 4000 ft. July 26, 1902.	E. B. Poulton.
183. *Machimus chrysitis*, Mg., ♀. See remarks by G. H. Verrall on No. 178. In Hope Dep.	The Acridian (Grasshopper), *Stenobothrus* (*Stauroderus*) *vagans*, Fieb., ♀.	La Granja, Spain, about 4000 ft. July 26, 1902.	E. B. Poulton.

184. *Machimus chrysitis*, Mg., ♀. See remarks by G. H. Verrall on No. 178. In Hope Dep.	The Ant, *Camponotus cruentatus*, Ltr., ♀, winged.	El Escorial, Spain, about 3400 ft. July 28, 1902.	E. B. Poulton. Trans. 1904, p. 631.
185. *Machimus chrysitis*, Mg., ♀. See remarks by G. H. Verrall on No. 178. In Hope Dep.	The Tiger-beetle, *Cicindela sylvatica*, L., ♂.	Pto. de Pajares, Spain, 4000 ft. July, 1904.	G. C. Champion.
186. *Machimus*, sp., ? *chrysitis*, Mg., ♂. The abdomen in this and the succeeding six specimens is of a more brilliant "old gold" colour than in typical *chrysitis*. In Hope Dep.	The Pierine butterfly (Large Garden White), *Pieris brassicæ*, L., ♀.	Hyères. June 17, 1898.	F. Reyne.
187. *Machimus*, sp., ? *chrysitis*, Mg., ♀. In Hope Dep.	The Honey-bee, *Apis mellifica*, L., ☿.	Behar, W. Central Spain, 3000 ft. June–July, 1902.	T. A. Chapman.
188. *Machimus*, sp., ? *chrysitis*, Mg., ♂ In Hope Dep.	The Aphodiid beetle (Dung-beetle), *Aphodius depressus*, Klug, ♀.	Pto. de Pajares, Spain, 4000 ft. July 12, 1904.	T. A. Chapman.
189. *Machimus*, sp., ? *chrysitis*, Mg., ♀: a small specimen. In Hope Dep.	The Melolonthid beetle (Chafer), *Rhizotrogus felicitanus*, Reitter, ♂. Cf. Trans., 1905, pp. 43, 44.	Pto. de Pajares, Spain. July 12, 1904.	T. A. Chapman.
190. *Machimus*, sp., ? *chrysitis*, Mg., ♀. In Hope Dep.	The Melolonthid beetle (Chafer), *Rhizotrogus felicitanus*, Reitter, ♂. Cf. Trans. 1905, pp. 43, 44.	Pto. de Pajares, Spain. July 3–21, 1904.	T. A. Chapman.
191. *Machimus*, sp., ? *chrysitis*, Mg., ♀. In Hope Dep.	The bee, *Andrena fuscipes*, Kirb., ♀	Pto. de Pajares, Spain. July 21, 1904.	T. A. Chapman.

SPECIES OF ASILID.	SPECIES OF PREY.	LOCALITY AND DATE.	OBSERVER.
III. ASILINÆ (*continued*).			
192. *Machimus*, sp., ? *chrysitis*, Mg., ♀. In Hope Dep.	The Acridian (Grasshopper), *Gomphocerus sibiricus*, L., ♂.	Pto. de Pajares, Spain. July 21, 1904.	T. A. Chapman.
193. *Machimus*, sp. nr. *fortis*, Lw., but distinct, ♂. In Hope Dep.	An Asilid fly of the same genus as its captor,—*Machimus setibarbus*, Lw., ♂. A small example.	The path to Peñalara, La Granja, Spain, about 5000 ft. July 25, 1902.	E. B. Poulton.
194. *Machimus*, sp., near but distinct from, *rusticus*, Mg., ♀, probably *basalis*, Lw. In Hope Dep.	The Nymphaline butterfly (Painted Lady), *Pyrameis cardui*, L., ♂. The captor astonishingly smaller than its prey.	Piedrahita, outer ridge of the Sierra de Gredos, W. Central Spain. July, 1902.	T. A. Chapman.
195. *Machimus*, sp. near but distinct from, *setibarbus*, Lw., ♂. In Hope Dep.	The Honey-bee, *Apis mellifica*, L., ☿.	Behar, W. Centr. Spain, 3300 ft. June–July, 1902.	T. A. Chapman.
196. *Machimus setibarbus*, Lw., ♀. In Hope Dep.	The Tabanid fly (Horse-fly), *Tabanus græcus*, F., ♀.	La Granja, Spain, about 4000 ft. July 24, 1902.	E. B. Poulton.
197. *Machimus setibarbus*, Lw., ♀. In Hope Dep.	The fly, *Musca vitripennis*, Mg., ♀.	Puerto de Pajares, Cantabrian Range, N. Spain, 4000 ft. July 21, 1904.	T. A. Chapman.
198. *Machimus gonatistes*, Zell., ♀. In Hope Dep.	The Acridian (Grasshopper), *Podisma frigida*, Boh., ♂.	Cerbère, Eastern Pyrenees, France. July 17, 1901,	E. B. Poulton. Trans. 1902, p. 335, where Asilid stands as *Epitriptus arthriticus*.

199. *Machimus gonatistes*, Zell., ♀. In Hope Dep.	The Acridian (Grasshopper), *Podisma frigida*, Boh., ♂.	Cerbère, Eastern Pyrenees, France. July 17, 1901.	E. B. Poulton. Trans. 1902, p. 335, where Asilid stands as *Epitriptus arthriticus*.
200. *Machimus atricapillus*, Fln., ♀. In Brit. Mus.	The Tabanid fly (Horse-fly), *Chrysops cæcutiens*, L., ♂.	Brockenhurst, New Forest. June 14, 1894.	J. W. Yerbury. Trans. 1902, p. 333.
201. *Machimus atricapillus*, Fln., ♂. In Hope Dep.	The Anthomyid fly, *Hylemyia*, sp. (headless).	Cusop Dingle, Herefordshire. July 26, 1902.	J. W. Yerbury.
202. *Machimus atricapillus*, Fln., ♀. In Hope Dep.	The Syrphid fly, *Melanostoma scalare*, F., ♀.	New Forest. Aug. 24, 1902.	W. J. Lucas.
203. *Machimus atricapillus*, Fln., ♀. In Hope Dep.	The Dolichopodid fly, *Dolichopus ungulatus*, L., = *æneus*, De G., ♀.	Deal. July 9, 1904.	A. J. Chitty.
204. *Machimus atricapillus*, Fln., ♀. In Hope Dep.	The fly (*Sarcophaginæ*), *Sarcophaga*, sp., ? *melanura*, Mg., ♀.	Deal, Sandhills. Aug. 6, 1905.	A. H. Hamm.
205. *Machimus atricapillus*, Fln., ♂ and ♀ *in cop.*, the ♀ with prey. In Hope Dep.	A ♀ Homopterous insect (Frog-hopper: *Cercopidæ*), of the genus *Athysanus*, probably *A. communis*, J. Sahl.	Newton Abbot, S. Devon. July 30, 1906.	A. H. Hamm.
206. *Neoitamus cyanurus*, Lw., ♀. In Brit. Mus.	The Aphodiid beetle (Dung-beetle), *Aphodius fimetarius*, L., ♀.	Lyndhurst, New Forest. June 25, 1894.	J. W. Yerbury. Trans. 1902, p. 333, where the prey is unnamed.

SPECIES OF ASILID.	SPECIES OF PREY.	LOCALITY AND DATE.	OBSERVER.
III. ASILINÆ (*continued*).			
* **207**. *Neoitamus cyanurus*, Lw., ♂. In Coll. C. Morley.	The Hepialid moth (Swift), *Hepialus hectus*, L., ♂.	Ipswich, woods near. June 13, 1896.	Claude Morley. E. M. M. 1896, p. 182.
208. *Neoitamus cyanurus*, Lw., ♂ and ♀ *in cop.*, the ♀ with prey. In Hope Dep.	The Tipulid fly (Daddy-longlegs), *Tipula scripta*, Mg., ♂.	Barmouth, N. Wales. July 6, 1902.	J. W. Yerbury.
209. *Neoitamus cyanurus*, Lw., ♀. In Hope Dep.	The Tachinid fly, *Varichæta* (*Erigone*) *nemorum*, Mg., ♀. (C. J. Wainwright, in E. M. M. 1905, p. 205.)	Newlands Corner, Surrey. June 18, 1904.	W. J. Lucas.
210. *Neoitamus cyanurus*, Lw., ♀. In Hope Dep.	The Cimicid bug, *Anthocoris sylvestris*, L.	Pamber Forest. May 30, 1903.	H. St.J. K. Donisthorpe.
211. *Neoitamus cyanurus*, Lw., ♀. In Hope Dep.	The Conopid fly (*Myopinæ*), *Myopa buccata*, L., ♂.	Bagley Wood, Oxford. June 10, 1905.	A. H. Hamm.
212. *Neoitamus cyanurus*, Lw., ♀. In Hope Dep.	The Syrphid fly, *Syrphus nitidicollis*, Mg., ♀.	Tubney Wood, near Abingdon. June 10, 1906.	A. H. Hamm.
213. *Neoitamus cyanurus*, Lw., ♀. In Hope Dep.	A fly: the specimen lost.	Tubney Wood, near Abingdon. June 10, 1906.	A. H. Hamm.

* **207**. Mr. G. H. Verrall has kindly sent me the following note on the moth-catching propensities of this species of Asilid:—
"*Neoitamus cyanurus* was lying in waiti n large numbers in Darenth Wood, on June 18th, 1868, on the leafless ends of the twigs of shrubs, and pouncing upon every specimen of *Tortrix viridana*, L., which flew past, though even fair-sized *Geometridæ* were also caught and eaten."

214. *Neoitamus cyanurus*, Lw., ♀. In Hope Dep.	The Empid fly, *Empis punctata*, Mg., ♀.	Tubney Wood, near Abingdon. June 10, 1906.	J. Collins.
215. *Neoitamus cyanurus*, Lw., ♀. In Hope Dep.	The Curculionid beetle (Weevil), *Polydrusus cervinus*, L., ♀.	Tubney Wood, near Abingdon. June 10, 1906.	J. Collins.
216. *Neoitamus*, sp., ♀. Asilid in Hope Dep.	"A beetle twice its own weight." Specimen not taken.	Disa, Bombay Presidency. June, 1897.	G. C. Nurse. Trans. 1902, p. 335, where Asilid is named *?longistylus*, an identification now thought erroneous by J. W. Yerbury.
217. *Epitriptus cingulatus*, F., ♀. In Hope Dep.	The common little moth, of obscure position in the Micro-Lepidoptera, —*Simaëthis fabriciana*, L.	Shotover Hill, Oxford. July 1, 1900.	A. H. Hamm.
218. *Epitriptus cingulatus*, F., ♀. In Hope Dep.	The fly, *Musca corvina*, F., ♂.	Walton, Surrey. Aug. 8, 1903.	H. A. Saunders.
219. A much greased ♀ Asilid. Considered by G. H. Verrall to be probably *Epitriptus inconstans*, Mg. In Hope Dep.	The Pyralid moth, *Cledeobia angustalis*, Schiff, ♂.	La Granja, Spain, 7000 ft. Aug. 2, 1904.	T. A. Chapman.
***220.** Sub-family *Asilinæ*, of doubtful genus and species, ♀. In Hope Dep.	The Melolonthid beetle (Chafer), *Hymenoplia strigosa*, Illig.	Vigo, N.W. Spain, sea-level to 200 ft. June 19–27, 1906.	T. A. Chapman.

* **220–224.** Mr. G. H. Verrall considers that it is inexpedient to attempt to work out the more obscure Spanish *Asilidæ* until far more material has been obtained from this country. This remark applies to several of the Spanish species of *Machimus* and probably to all Iberian *Dysmachus*. See note on p. 350.

SPECIES OF ASILID.	SPECIES OF PREY.	LOCALITY AND DATE.	OBSERVER.
III. ASILINÆ (*continued*).			
221. Sub-family *Asilinæ*, ♀, different from 220. In Hope Dep.	The Aphodiid beetle (Dung-beetle), *Aphodius fimetarius*, L., ♂.	Vigo, N.W. Spain, sea-level to 200 ft. June 19–27, 1906.	T. A. Chapman.
222. Sub-family *Asilinæ*, ♂, different from two preceding. In Hope Dep.	The Tipulid fly (Daddy-longlegs), *Tipula lateralis*, Mg., ♂.	Casayo, S.E. of El Barco, N.W. Spain, about 3500 ft. July 2–9, 1906.	T. A. Chapman.
223. Sub-family *Asilinæ*, ♀, different from three preceding. In Hope Dep.	The Glaphyrid (Lamellicorn) beetle, *Chasmatopterus pilosulus*, Illig., ♂.	Casayo, S.E. of El Barco, N.W. Spain, about 3500 ft. July 2–9, 1906.	T. A. Chapman.
224. Sub-family *Asilinæ*, ♂, different from four preceding. In Hope Dep.	The Noctuid moth (the Silver Y), *Plusia gamma*, L., ♀.	Brañuelas, Leon, N.W. Spain, about 3200 ft. July 11–15, 1906.	T. A. Chapman.
In addition to the above there are the following records of attack by uncaptured and undetermined species of *Asilidæ*. The prey also was untaken.			
225. ?Sub-family, gen., and sp.	The Nymphaline butterfly, *Precis elgiva*, Hew.	Malvern, Natal, 7–800 ft. March 28, 1897.	G. A. K. Marshall. Trans. 1902, p. 333.
226. ?Sub-family, gen., and sp.	The Acræine butterfly, *Acræa caldarena*, Hew.	Umtali, Mashonaland, 3700 ft. Dec., 1900.	G. A. K. Marshall. Trans. 1902, p. 333.

Certain general conclusions of much interest may be reached from the study of the preceding list.

Proportions of the Sexes.

Females are far more commonly found with prey than males—being in fact between three and four times as numerous. These results will be found to be curiously reversed in the case of the *Empidæ* (p. 388). The following table shows the exact proportion of the two sexes in the recorded examples :—

	FEMALES.	MALES.	SEX DOUBTFUL.
Dasypogoninæ	51	17	10
Laphrinæ	12	2	1
Asilinæ	97	28	8
Totals	160	47	19

Nos. 225 and 226 are omitted from the above table, but the total reaches 226 because three individuals are included under the single No. 117.

Analysis of the Prey.

Although conclusions of interest at once suggest themselves when the sexes of Asilid victims are studied, the consideration of this part of the subject is postponed until after the accumulation of a far larger number of data.

Before proceeding to consider the list of *Asilidæ* in detail it is of importance to analyse the prey as a whole. We shall thus gain a standard with which to compare the habits of particular species and genera of these predaceous flies.

ANALYSIS OF PREY.

I. Orthoptera.

Acridiidæ (Grasshoppers) 13

Total . . . 13

II. Neuroptera.

Termitidæ (White ants)	2
Odonata (Dragonflies)	4
Panorpidæ (Scorpion-flies)	1
Total	7

III. Hemiptera.

Coreidæ	2
Lygæidæ	1
Pentatomidæ	1
Cimicidæ	1
Total	5

IV. Homoptera.

Cicadidæ	6
Cercopidæ	1
Total	7

V. Coleoptera.

Undetermined	2
Cicindelidæ	1
Hydrophilidæ	1
Copridæ	5
Aphodiidæ	4
Glaphyridæ	6
Melolonthidæ	11
Rutelidæ	1
Cetoniidæ (1 abandoned)	2
Buprestidæ	1
Galerucidæ	1
Melyridæ	2
Lagriidæ	1
Cantharidæ	1
Curculionidæ	1
Total	40

VI. Lepidoptera.

A. Heterocera.

Hepialidæ (Swifts)	1
Lymantridæ	1
Geometridæ	2
Noctuidæ	2
Pyralidæ	2
Crambidæ (Grass-moths)	2
Tineidæ (Including 1 *Adela*? and 1 *Simaëthis*)	3

B. Rhopalocera.

Danainæ	2*
Acræinæ	1
Nymphalinæ	3
Lycænidæ (Blues)	6
Pierinæ (Whites)	7†
Total	32

VII. Hymenoptera.

A. Phytophaga.

Tenthredinidæ	1

B. Parasitica.

Chalcididæ	1
Ichneumonidæ	10
Braconidæ (1 doubtful)	2

C. Aculeata.

Anthophila (Bees)	Hive-bee	14
	African form of hive-bee	1
	Other Anthophila	14
Diploptera (Wasps)		6
Fossores (Sand-wasps)		9
Heterogyna (Ants)		9
	Total	67

* Including the *L. chrysippus* mentioned in the footnote on p. 345.
† Including the *C. florella* mentioned in the footnote on p. 346.

VIII. Diptera.

Undetermined		1
Tipulidæ (Daddy-longlegs)		5
Stratiomyidæ		1
Tabanidæ (Horse-flies)		4
Asilidæ	Females devouring males of same sp.	3
	" " females "	1
	Prey a species different from captor	10
Empidæ		3
Dolichopodidæ		1
Syrphidæ		8
Conopidæ		2
Tachinidæ		2
Sarcophaginæ		5
Dexinæ		1
Muscinæ		4
Anthomyidæ		6
	Total	57

The whole of the 226 records in the tabular statement are included in this analysis, except No. 29, in which the nature of the prey is uncertain. To these 225 are added the 2 butterflies in the footnotes on pages 345, 346, together with one extra example, because three victims accompany the two Nos. 59 and 117 in the Table. Thus the total number included in the analysis of prey is 228.

A glance at the above list shows that the Hymenoptera, Diptera, Coleoptera, and Lepidoptera, placed in the order of importance, make up between them $\frac{9}{10}$ of the recorded prey. The other Orders are of small importance, but it is a striking fact that *Acridiidæ* are the only recorded prey among the Orthoptera, *Cicadidæ* (except for a single Cercopid) among the Rynchota Homoptera.

Hymenoptera.—About 30% of the entire records belong to this order. The Aculeata are strongly represented, other groups except the *Ichneumonidæ* (restricted), very weakly. Among the Aculeates the Anthophila include more than half the victims; but this immense preponderance is brought about by the numbers of *Apis mellifica*. Reasons will be given below (p. 366) for the conclusion that the hive-bee, weakened by domestication, is an easy prey,—a conclusion supported by the fact that there is only

a single record* of the capture of the African wild form of the species as compared with 14 of the European domesticated race. It is interesting to observe that the Fossors contribute more victims than the Diploptera. The latter are doubtless more formidable and chiefly attacked by specially adapted Asilids. The ants were probably all winged when captured, and the numbers must here be considered in relation to the limited period when the prey possesses the power of flight.

DIPTERA.—The most striking facts are the wide range of selection in the Order, and the marked predominance in the number of victims from the *Asilidæ* themselves (14 out of a total of 57). This predominance goes some little way to reduce the economic significance of *Asilidæ* as destroyers of insects.

COLEOPTERA.—The range of selection is here also very wide, but there is this in common between the victims: all are conspicuous flower-haunting forms or species which are freely upon the wing by day.

LEPIDOPTERA.—The range of selection is wide, the only predominance being among the *Lycænidæ* and *Pierinæ*—probably the two groups of butterflies most abundant in individuals. The moths—with the possible exception of the single Hepialid—are probably all such as are on the wing by day or fly readily when disturbed.

Looking at the list as a whole there is, as we should expect, a marked absence of purely cursorial forms and of forms that hide by day.

ASILIDÆ AS THE ENEMIES OF SPECIALLY PROTECTED INSECTS.—This investigation into the habits of predaceous insects was largely undertaken in order to ascertain the enemies of the specially protected groups. The conclusion had already been provisionally reached that the *Asilidæ* take an important place among these foes (Trans. Ent. Soc. Lond. 1902, pp. 336–337). "The stings of the Aculeates, the distasteful qualities of *Danainæ* and *Acræinæ* and of the odoriferous *Lagria*, the hard chitinous covering of Coleoptera, the aggressive powers of Odonata, are alike insufficient protection against these active and voracious flies." The sentence just quoted (l. c. p. 336) conveyed the

* Mr. Guy A. K. Marshall however writes as follows (Nov., 1906):—"Mr. E. S. Buttemer, of Estcourt, Natal, who kept wild bees on a considerable scale, told me that they were much preyed upon by *Asilidæ*."

impression made by a study of 36 examples (pp. 332–335). The conclusions expressed are confirmed and extended by the consideration of 190 additional examples recorded in the present Memoir.

The analysis on pp. 359–362 makes evident the following facts :—

1. The great predominance among the prey of that specially defended Order, the Hymenoptera, and within its limits of the section including the stinging insects.
2. The fact that half the families of Coleoptera which contributed victims are looked upon as specially protected :—The *Galerucidæ, Melyridæ, Cantharidæ, Aphodiidæ, Cetoniidæ, Lagriidæ,* and *Cicindelidæ* (Trans. Ent. Soc. Lond. 1902, pp. 392–397).*
3. Among Rhopalocera the inclusion of Danaine, Acræine and Pierine (including *Mylothris*) victims: among Heterocera of a Lymantrid victim.
4. The existence, although in small numbers, of Hemipterous prey.

Conclusions as to the habits of the species and genera of Asilidæ recorded in this Memoir.

I. Dasypogoninæ.

Dioctria (Nos. 1 to 10).—It is not necessary to present any further analysis of the tabulated record in the case of this genus. It is obvious that *Ichneumonidæ* form the chief prey of these slender Ichneumon-like Asilids (Trans. Ent. Soc. Lond. 1902, p. 336). In 4 out of 10 examples the prey belonged to this group; while in the whole of the *Asilidæ* other than *Dioctria,* only 6 instances of Ichneumonid prey are tabulated. Hence we are led to believe that the species of *Dioctria* are the chief Asilid

* This list of specially protected Coleopterous victims will undoubtedly be extended. Indeed some evidence is already in existence as recorded in the following statement by Kirby and Spence (Fifth edn. 1828, vol. i, p. 396), which I owe, together with the quotations on pp. 365 and 388, to Mr. A. H. Hamm, Assistant in the Hope Department :—" De Geer has seen an Asilus pierce . . . the elytra of a lady-bird ; and I have myself caught them with not only an *Elater* and weevil, but even a *Hister* in their mouths."

foes of the *Ichneumonidæ*.* The other insect prey is very varied : a Bracon ?, a Tenthredinid, two flies, (a Syrphid and an Empid), a *Panorpa* and a small moth. Further material is greatly needed in order to test the provisional conclusions here arrived at, and to afford grounds for estimating the relative influence of the various species of the genus.

Dasypogon (*Selidopogon*) *diadema*, Nos. 11—55.—The record in the case of this species is remarkably complete, no less than 45 examples being tabulated. Of these all except one, in which the nature of the prey is uncertain, are available for an analysis which demonstrates at a glance the relative preferences of this predaceous species.

The Prey of Dasypogon (Selidopogon) diadema.

HEMIPTERA.		
Coreidæ		1
	TOTAL	1
COLEOPTERA.		
Hydrophilidæ		1
Copridæ		1
Glaphyridæ		3
Cetoniidæ	(abandoned)	1
	TOTAL	6

* That the Hymenoptera are the special victims of *Dioctria* was well known to Kirby and Spence. Thus we read (Fifth edn. 1828, vol. i, p. 274) :—" The *Asili* also, which are always upon the chase, seize insects with their anterior legs and suck them with their haustellum. The cognate genus *Dioctria*, particularly *D. ïcelandica*, prey upon *Hymenoptera*, by some unknown means instantaneously killing the insect they seize."

This last observation is also of great interest. The collapse of the Asilid's victim—often an active powerful insect—is so instantaneous that there can be little doubt that a poison is injected. In the case of *Laphria gibbosa* (No. 86) which was devouring the Buprestid beetle *Ancylocheira flavomaculata* (see p. 339) the proboscis was thrust through the cephalo-thoracic articulation. Dr. Chapman has pointed out to me that if the beetle had not been already killed or killed the *instant* of insertion it could have crushed the Asilid's proboscis with ease. When an Asilid is captured and held by the wings it often extrudes as if in defence a frothy liquid from the end of its proboscis ; and it is probable that this is the poison. It would be interesting to experiment upon insects with it, introducing a minute quantity by means of a finely drawn out glass tube.

HYMENOPTERA.		
Ichneumonidæ		3
Anthophila	Hive-bee	12
	Other Anthophila	5
Diploptera		3
Fossores		4
Heterogyna		5
	TOTAL	32

DIPTERA.		
Asilidæ	♀ eating ♂ of own sp.	1
	Prey a sp. different from captor	1
Syrphidæ		2
Sarcophaginæ		1
	TOTAL	5

Comparing this analysis with that of all the recorded prey of *Asilidæ*, we find no examples of *D. diadema* attacking Orthoptera, Neuroptera, Homoptera, or Lepidoptera, and only a single instance in which Hemipterous prey was selected. Rather less than $\frac{1}{8}$ of *D. diadema's* captures were selected from among the Coleoptera, and an equal proportion from the Diptera. The great majority of the victims, $\frac{3}{4}$ of the whole, were Hymenopterous, and of these about half belonged to the Anthophila. The numbers of these latter are inflated by the abundance of the hive-bee and probably by the fact that this artificially protected species is extremely abundant in certain localities, and especially easy to capture. Probable evidence of the comparative helplessness of the hive-bee is afforded by the following considerations. The sexes are recorded in 42 out of the 45 tabulated examples of this Asilid: 30 were females, 12 were males. The smaller weaker males selected upon the whole smaller weaker victims than the females. But in 3 cases out of the 12 the comparatively large and heavy hive-bee worker was found in the clutches of a male *diadema*. As regards the female also, the 9 hive-bees were considerably larger than the average of the other victims selected by this sex. (See also p. 362.)

The Courtship of Dasypogon (Selidopogon) diadema.

Only a single pair were observed *in coitu*, both male

and female being without prey at the time. On the other hand three females with prey (Nos. 22, 25 and 40) were seen to be persistently courted by males. In one case (No. 40) both sexes were resting on a leaf, the female absorbing the juices of a small ♀ Ichneumonid, *Pimpla* (*Itioplectis*) *pomorum*, which was soon sucked dry. She then deliberately withdrew her proboscis from the victim and dropping it upon the leaf faced round upon her suitor in a menacing manner. The male, as if realizing the danger, at once became far more cautious and wary in courtship. When we remember that once in this species (No. 41), and once each in the case of two other species of *Asilidæ*, *Promachus æqualis* (No. 96), and *Promachus, sp. A.* (No. 103), the female has been captured devouring the male of her own kind, we can well understand the increased wariness observed on this occasion, as well as the persistent courtship of females already provided with prey and the well-known examples of females with prey captured *in coitu.** Four instances of this latter kind are recorded in the present paper,—*Laphria gibbosa*, No. 86; *Eutolmus apicatus*, No. 175; *Machimus atricapillus*, No. 205, and *Neoitamus cyanurus*, No. 208. That the male is extremely wary in the courtship of females without prey, the following observations upon *D. diadema* sufficiently prove.

July 24th, 1902, 11.45 a.m. La Granja, Sierra Guadarrama, Spain.—I watched a male *Dasypogon diadema* pursuing the female. Every time the female flew the male followed and almost invariably settled behind, about three or four inches away, with his head towards her. Sometimes the female on alighting turned round so as to face the direction from which she had flown, and the pursuing male; but the latter flew round her and took up the characteristic position behind. Not only on these occasions but usually the male flew once or twice round her before alighting, but until the final act this particular male never touched the female. About a quarter of a minute after settling the male flew nearer to the female. Although only three or four inches away he did not walk but flew towards her, taking up a nearer position, in which he sometimes faced her from the side, sometimes

* Also frequently observed in the *Empidæ*, as stated by Kirby and Spence. For their amusing conjectures as to the significance of the fact see footnote † on p. 388.

from behind. On one occasion he alighted only an inch behind the female.

The only movements observed in the female after alighting were of the head, but the male often fluttered his wings.

Pairing took place after the courtship had been watched for six minutes, during which the insects flew and alighted several times. The male seized the female in the air after she had flown a short distance, and both fell to the ground together from a height of about eight inches. Copulation probably occurred the instant the insects reached the ground, but the movements were too rapid to be followed. In flight the female supported the male, but the horizontal position of the latter was apparently maintained by the use of his wings. When the female alighted the male always hung in a vertical position. *Coitus* was not terminated by capture, or even by boxing.

The courtship of another pair was watched on the same morning and in the same locality. *Coitus* was not seen, the insects being lost after 12½ minutes of observation. In this case the female when settled moved her abdomen up and down. Movements of the third pair of legs were also seen, while those of the head were frequent and pronounced. The male also sometimes faced the female, and once or twice darted down upon her, certainly touching some part of her dorsal surface.* After one of the flights, when they had come to rest upon a couple of flower-heads about two inches apart, the male more than once took a turn in the air round the female, and then returned to his flower-head. In spite of the differences here stated, the relative positions of male and female were generally similar to those of the last pair. In fact, the positions first taken up after each flight of the female are probably characteristic.

Dasypogon (Selidopogon) diadema, a mimic of its most conspicuous victims.

The dark-winged, dark-bodied *Dasypogon diadema* is undoubtedly mimetic of the Hymenoptera Aculeata.

* A male, watched on the previous day, July 23, also appeared to dart at and touch the female. The observation was made in the same locality, and the female was in this instance carrying a bee.

Especially is this true of the female, which with a red band across the abdomen, strongly suggests the appearance of a large group (Trans. Ent. Soc. Lond., 1904, pp. 647, 648) of similarly banded Aculeates. Out of 29 Aculeate victims three belonged to the group in question, —*Pompilus viaticus*, *Sphecodes gibbus*, and *Ammophila hirsuta.* All three were captured by female Asilids. With the exception of a single *Bombus* these three victims are the most conspicuously marked of all the prey of *D. diadema,* and the most suitable models for mimetic resemblance. (Trans. Ent. Soc. Lond., 1904, pp. 661–662.)

Remaining genera of the Dasypogoninæ.

Of these there is not much to be said, inasmuch as the number of records is insufficient to justify conclusions as to preferences. Especially is this the case with *Saropogon*, Nos. 56, 57, and *Isopogon*, No. 66; while the three examples of a single species of Tipulid prey seized by the bee-like *Lasiopogon cinctus*, Nos. 76–78, were all observed in the same locality and at nearly the same time. However, so far as it goes the evidence certainly suggests a mainly Dipterous diet for this latter species. The seven or eight victims recorded for the genus *Microstylum*, Nos. 58–65, indicate comprehensive tastes; including 3 beetles, 2 or 3 Cicadas (or possibly a Vespid), 1 grasshopper and 1 Asilid fly. The huge *Microstylum dux* appears to be an Aculeate mimic. *Stenopogon*, Nos. 67–69, twice captured the specially protected *Melyridæ* among the Coleoptera, and once a well-defended bug, *Thyanta.* In *Scleropogon*, Nos. 71–73, alone among the *Dasypogoninæ*, we meet with the record of a butterfly victim, a species of the distasteful sub-family *Danainæ.* The two remaining captures recorded for this genus are Asilid flies. One of these offers an example—so far unique—of a female Asilid preying upon another female of the same species. The two species of *Damalina*, Nos. 74, 75, are probably specialized foes of the Dammar-bees (*Melipona*), and both are beautiful mimics of their victims. The two tabulated examples support this conclusion, but further observation is greatly wanted. Colonel C. T. Bingham, to whom we owe both the records, has however recorded that flies of this genus "persistently hover round the nest-mouth of the dammar bees, and catch the latter on the wing as they issue from the nest." (Trans. Ent. Soc. Lond. 1902, p. 336.)

II. Laphrinæ.

The number of records in this sub-family is small, so small indeed that we can only reach provisional conclusions as to the preferences of the species. Mimicry of the Hymenoptera Aculeata is here more conspicuous than elsewhere among these predaceous flies. *Lamyra* (Nos. 91, 92) and *Proagonistes* (No. 93) are beautiful mimics of dark-winged Aculeates, and two out of the three recorded individuals were preying upon Aculeates, although not upon their models. It is probable that these species present us with a case similar to *Dasypogon diadema*, where there is a general attack upon the Aculeata accompanied by mimicry of a type of colouring common and specially conspicuous, but by no means universal among the victims. The bee-like *Laphria*, sp. ? *gilva* (No. 89), was captured with a fly, *Laphria gibbosa* (Nos. 86, 87), a mimic of the heavy *Bombus* type of Aculeates, was twice, and the bee-like *Hoplistomerus serripes* (No. 79) once, recorded with a beetle. These species may probably be grouped with the common *Asilus crabroniformis*, mimetic of a specially abundant and conspicuous Aculeate type, but showing no preference for an Aculeate diet. *Laphria flava* (No. 88), —also *Bombus*-like—recorded with an ant, may perhaps belong to the same category as *Lamyra* and *Proagonistes*. The species of *Laxenecera* (Nos. 80–83)—all mimetic of Aculeates (bees) and all preying upon Aculeates although usually not upon their models—appear undoubtedly to belong to this latter category. *Hyperechia* (Nos. 84, 85), long suggested as a specialized foe of the Aculeate genus *Xylocopa* (Trans. Ent. Soc. Lond. 1904, p. 662, and Proc. 1904, p. lxxxvi), has now for the first time been proved to prey upon its model. It offers a case precisely parallel to that of *Damalina*.

Not only are the *Laphrinæ* here recorded more generally mimetic than the species of either of the other sub-families but their resemblances are curiously restricted to the group of bees (Anthophila), although *Lamyra* and *Proagonistes* offer magnificent exceptions.

III. Asilinæ.

Craspedia (No. 94), now shown for the first time to attack the *Xylocopidæ*, is probably a specialized foe of these bees,

and is a mimic of its victim. Save for the less perfect mimetic resemblance, it falls into the same category as *Damalina* and *Hyperechia*.

Promachus (Nos. 95–121).—We find in this large genus examples sufficiently numerous and interesting to justify separate tabulation.

The Prey of Promachus.

		PROMACHUS ÆQUALIS.	PROMACHUS, OTHER SPECIES.
NEUROPTERA	*Termitidæ*	2	
	ODONATA		3
HEMIPTERA	*Coreidæ*		1
HOMOPTERA	*Cicadidæ*		3 or 4*
COLEOPTERA	*Coridæ*	2	
	Melolonthidæ	1	
	Rutelidæ		1
	Lagriidæ	1	
HYMENOPTERA	*Ichneumonidæ*		2
	ANTHOPHILA (*Apidæ*)		1
	DIPLOPTERA		1 or 2*
	FOSSORES		1
	HETEROGYNA (*Formicidæ*)		1
DIPTERA	*Tabanidæ*		1
	Asilidæ — ♂ *of same species.*	1	1
	Asilidæ — *prey different sp.*		3
	Sarcophaginæ		1
	Totals	7	21 or 22

* One of these alternatives—*Cicadidæ* or Diploptera—must be included, and both may be : see No. 117, p. 344.

Promachus æqualis (Nos. 95–101) is probably an imperfect mimic of the white-banded *Xylocopidæ*; but with the exception of the winged Termites and the male of its own species, its victims (4) were all Coleopterous. Hence if a mimic at all it must be classed with *Asilus crabroniformis* (Nos. 149–156). The second column of the table includes a fine species, *testaceipes*? (No. 117), from Macao, probably mimetic of a wasp. Its prey is insufficiently known, but must include one, perhaps two wasps, although apparently not the model, and may include a Cicada. The tolerably indiscriminate list of victims in this column seems however to indicate an undoubted preference for Dragonflies and Cicadas, inasmuch as the majority of the records of these insects are here to be found.

Philodicus, Alcimus and *Apoclea* (Nos. 122–140).—We here encounter the most obvious preference for a particular diet to be met with anywhere among the *Asilidæ*, except in those specialized forms which prey upon their models. Omitting the doubtfully determined *Philodicus* sp., which had attacked a Tachinid fly, the prey of the remaining species of these three genera is tabulated below:—

The Prey of Alcimus and allied genera.

		ALCIMUS 3 SPECIES.	APOCLEA FEMORALIS.	PHILODICUS GRACILIS.
ORTHOPTERA, *Acridiidæ*		4		
LEPIDOPTERA HETEROCERA	*Lymantridæ*	1		
	Noctuidæ	1		
	Pyralidæ	1		
LEPIDOPTERA RHOPALOCERA	*Nymphalinæ*	1		
	Lycænidæ	4		1
	Pierinæ	3	1 or 2	
	Totals	15	1 or 2	1

When this table is compared with the general analysis of prey (pp. 359, 361), the preference for Lepidoptera and Orthoptera will be seen to be remarkably clear. As re-

gards Rhopalocera the preference is even more marked than this comparison suggests; for some and perhaps all the butterflies seized by uncaptured Asilids were probably the prey of *Alcimus.* The species of this genus stand out as by far the most important of the Asilid foes of butterflies, and the study of the habits of the group is especially commended to those who believe that all *Asilidæ* are indiscriminate in their attacks on insects. The preference for Lepidoptera manifested in common by these genera is an interesting example of the support which a purely structural foundation for affinity may receive from the study of instincts, themselves the outcome of structure in the central nervous system.

As regards mimicry the remarkably long-bodied species of these three genera are perhaps protected by a vague resemblance to the more slender Hymenoptera—Parasitic or Aculeate—but, as the above analysis shows, they have not been hitherto observed with victims belonging to this Order.

Philonicus (two species), Nos. 141–147.—So far as the insufficient evidence justifies any conclusion this genus appears chiefly to attack Diptera (6 examples), although a single Tineid victim is also recorded.

Pamponerus germanicus (No. 148).—The single example —a Melolonthid beetle—does not justify conclusions as to the preferences of this species.

Asilus crabroniformis (Nos. 149–156).—Considering the abundance and conspicuous appearance of this fine insect the records of prey are somewhat scanty. I am myself familiar with the species in several localities but have only once seen it with prey—a beetle (No. 150). The other tabulated instances, including 3 different grasshoppers, indicate a preference for Orthoptera and Diptera. The four recorded examples of the latter Order belong to four different families or sub-families—*Asilidæ*, *Syrphidæ*, *Sarcophaginæ* and *Muscinæ*. *Asilus crabroniformis* "recalls in a general way the type of Aculeate colouring and pattern which is commonest and most conspicuous in its region" *—especially the black and yellow banded appearance of the most abundant Palæarctic species of *Vespa.* At the same, time I have been unable to find a single example of an attack by this species upon Hymenoptera.

* Trans. Ent. Soc. Lond. 1904, p. 662.

An observation on the cryptic attitude of Asilus crabroniformis during prolonged rest.

As this Memoir contains certain miscellaneous observations upon the *Asilidæ,* such as the notes upon the courtship of *Dasypogon* (*Selidopogon*) *diadema* on pp. 366–368, I have thought it worth while to include the following. On the evening of July 28, 1906, I observed a female of this species at rest on a head of *Centaurea scabiosa* beside the footpath leading to Stone's Copse, above North Hinksey, near Oxford. The insect had evidently gone to rest for the night and was quite torpid. The appearance *strongly* suggested a rolled-up crumpled brown leaf or leaf-fragment which had accidentally fallen upon the flower. This cryptic resemblance was brought about by a remarkable attitude, the insect being precisely in the position formed by a half somersault,—arrested when the ventral surface was uppermost. Hence the closely-folded wings and the conspicuous gold and black bands were entirely invisible from above; the only appearance being that of the brown shades on the legs and ventral surface. The colouring of these was so beautifully adapted to produce the cryptic effect suggested above that I think it is probable that I witnessed a single example of an attitude commonly assumed by the species during prolonged rest.

Lophonotus (two species), Nos. 157–162.—Hymenoptera contribute half of the six victims recorded for this genus. The list is as follows: a Dragonfly, a beetle, a Geometrid moth, two Fossorial wasps, and a Chalcid. Some preference for Hymenoptera may be regarded as probable.

Dysmachus (Nos. 163–174).—Five species have been discriminated by Col. Yerbury and Mr. Verrall in the material upon which this paper has been prepared. (See, however, note on p. 350.) They differ but slightly in size and superficially resemble each other in appearance. Twelve examples are tabulated, the prey belonging to the Coleoptera (3 Melolonthids, 1 Coprid), Lepidoptera (1 Geometrid, 2 Crambids), Diptera (1 Stratiomyid, 1 Empid, 1 Anthomyid), and Hymenoptera (1 Ichneumon, 1 winged ant). At first sight the selection seems entirely indiscriminate and haphazard, but when regard is paid to the circumstances of the case it is found that choice was exercised at least in one case. When I captured the three specimens (Nos. 169, 170, 172) with Melolonthid

victims on Peñalara, these beetles were by no means conspicuously common, while on the same ground the grasshopper, *Gomphocerus sibiricus*, was positively swarming. This species is certainly attacked by other kinds of Asilids: an example is in fact put on record in the table (No. 192). The attacks upon Lepidoptera also probably indicate some preference, especially when we consider that only one other Geometrid victim is recorded,* and that, except *Dysmachus*, no Asilid is known as the captor of a *Crambus*.

Eutolmus (Nos. 175, 176).—Of the two species one is not with certainty to be included in this genus. The records are insufficient to justify conclusions; but there is one interesting point about *Eutolmus apicatus* which deserves notice. The species was very common on Montserrat, and 14 specimens (6 ♂ and 8 ♀) captured July 14–15, 1901, exist in the Hope Collection: yet only a single pair of the insects were observed *in coitu*, and the female of this pair was the only individual of the species observed with prey (an Anthomyid fly). The coincidence supports the conclusion already arrived at, that females with prey are especially sought by the males (p. 367).

Machimus (Nos. 177–205).—At least 7 species are discriminated by my kind friends Col. Yerbury and Mr. Verrall; and no less than 29 examples of prey are recorded. These are so numerous and striking that the results are shown below in a tabular form on page 376.

Certain preferences are very obvious in this table. The choice of Acridians is clearly seen in the fact that nearly half the number recorded for the whole of the *Asilidæ* are found in the first two columns. Apart from this, the best known form is seen to attack beetles freely, Hymenoptera and Diptera slightly, while there is a single record of a butterfly and a Lygæid bug among the victims. *M. setibarbus* is only known to attack Diptera. The British species also exhibits a strong preference for Diptera; for these contribute 5 out of the 6 records of prey. The sixth record is interesting, as it affords the only example of an attack on the *Cercopidæ* as yet observed among Asilids.

Neoitamus (Nos. 206–216).—Of the two species with prey there is, in the case of the British form, *N. cyanurus*, evidence suggesting that Diptera are the chief element in

* See, however, footnote on p. 356.

The Prey of Machimus.

		M. chrysitis * and ? chrysitis.	M. gonatistes.	M. setibarbus	M. atricapillus.	3 undetermined species.
ORTHOPTERA	*Acridiidæ*	3	2			
HEMIPTERA	*Lygæidæ*	1				
HOMOPTERA	*Cercopidæ*				1	
COLEOPTERA	*Cicindelidæ*	1				
	Copridæ	1				
	Aphodiidæ	1				
	Glaphyridæ	1				
	Melolonthidæ	2				
LEPIDOPTERA Rhopalocera	*Nymphalinæ*					1
	Pierinæ	1				
HYMENOPTERA Aculeata	Anthophila (*Apidæ*)	2				1
	Heterogyna (*Formicidæ*)	1				
DIPTERA	*Tabanidæ*	1		1	1	
	Asilidæ	1				1
	Dolichopodidæ				1	
	Syrphidæ				1	
	Sarcophaginæ				1	
	Muscinæ			1		
	Anthomyidæ				1	
	Totals	16	2	2	6	3

* Including three uncaptured specimens probably belonging to this species.

a mixed diet. Six examples out of ten belong to this Order (1 Tipulid, 1 Empid, 1 Conopid, 1 Syrphid, 1 Tachinid, 1 uncertain), the other victims being an Aphodiid and a Curculionid beetle, a Cimicid bug, and a Hepialid moth.* A single example of another species of the genus *Neoitamus* was carrying a beetle.

Epitriptus (Nos. 217–219).—The three victims (2 small moths, and 1 Muscid) recorded for two species are quite insufficient as evidence for the existence of any preference; but comparing the number of the moths with that shown in the complete analysis (p. 361), it becomes not improbable that future observation will demonstrate some preference for this diet.

The remaining records (Nos. 220–226), dealing with undetermined *Asilidæ*, cannot of course be considered in this section.

Mimicry in Asilidæ recorded with Prey.

The statements on mimicry and its varying relationship to the prey attacked by the mimetic species, scattered through the preceding pages, and already published (Trans. Ent. Soc. Lond. 1904, pp. 661–665) may now be gathered together into a tabular statement. It is important to remember that most of the species are only provisionally included in their respective groups on account of the insufficiency of the records. It is hoped however that the publication of a tabulated scheme, given on page 378, will stimulate observation and the preservation of material, so that at no distant date the means for a more comprehensive and more trustworthy classification may be gained.

* Mr. G. H. Verrall's observation recorded in footnote * on p. 356, proves that moths are sometimes attacked on a large scale by this species.

Section	Subfamily	Mimetic Species of Asilid	Model	Prey
I. Mimicry of Hymenoptera, which however are not attacked, or only in due proportion as part of a general insect diet. The examples placed under this head do not at present include the record of such an attack. Type of Section, *Asilus crabroniformis*.	*Dasypogoninæ*	*Lasiopogon cinctus*	A small bee	*Tipula*,—3 records
	Laphrinæ	*Laphria gibbosa*	A bee of the genus *Bombus*	Beetles,—2 records
		Laphria, sp. ? *gilva*	A hairy bee such as a very small *Bombus*	Flies,—1 record
		Hoplistomerus serripes	A rather large bee	A beetle,—1 record
	Asilinæ	*Promachus æqualis*	A white-banded Xylocopid bee	Beetles—4, Termites—2, ♂ of its own species—1
		Philodicus gracilis } *Alcimus*, 3 African sp. } *Apoclea femoralis* }	Long-bodied slender Aculeate or Ichneumonid	Lepidoptera,—18 or 19 records: grasshoppers, 4 records
		Asilus crabroniformis	A large yellow dark-banded Aculeate	Flies,—4 records: beetle, —1 record: grasshoppers,—3 records
II. Mimicry of Hymenoptera, which are especially or perhaps in some cases exclusively attacked. The attack on this Order is general and by no means limited to the models, which however are probably always present among the prey. It is obvious that some of the examples are only provisionally included under this head, the evidence being very insufficient. Type of Section, *Dasypogon diadema*.	*Dasypogoninæ*	*Dioctria*, 3 British species	*Ichneumonidæ*	Insects of various orders, but chiefly *Ichneumonidæ*
		Dasypogon diadema ♀	Dark red-banded Aculeates, *Pompilus*, *Ammophila*, &c.	Insects of various orders, but Aculeates far more frequently than others. Models of ♀ ♀ are among the most conspicuously coloured of the prey
		Dasypogon diadema ♂	Uniformly dark Aculeates	
		Microstylum dux	Large Aculeate	Cicada and beetle: may also include wasp
	Laphrinæ	*Laphria flava*	Bees of the genus *Bombus*	The single record is an Aculeate—an ant
		Laxenecera, 2 African species	Bees of medium size	The three examples were all Aculeates, but quite unlike the Asilids
		Lamyra, sp. ? *gulo*	A slender blue-black yellow-barred Aculeate	Of the two records one is an Asilid fly while the other is a wasp (*Belenogaster*) unlike its captor in appearance
		Proagonistes, sp. ? *præceps*	A large dark Fossor with orange legs, such as *Salius*	The single record is a small bee (*Halictus*) totally unlike its captor
	Asilinæ	*Promachus*, sp. ? *testaceipes*	Large Aculeate	A large *Vespa*,—apparently not a model—was certainly attacked, 1 or 2 records: also perhaps one Cicada
III. Mimicry of Hymenoptera, the models forming the only prey. Many more records required to confirm the presence of *Laxenecera flavibarbus* and *Craspedia* Types of Section, *Damalina*, *Hyperechia xylocopiformis*.	*Dasypogoninæ*	*Damalina*, 2 Burmese species	The black and white Dammar bees (*Melipona*)	The models
	Laphrinæ	*Laxenecera flavibarbus*	A bee of medium size	The single record is a bee (*Apis florea*) which the captor superficially resembles
		Hyperechia xylocopiformis	Dark Xylocopid bees	The models,—one record and another probable one
	Asilinæ	*Craspedia*, sp. from Queensland	Dark Xylocopid bees	The models,—one record

B. Empidæ and their Prey.

Sixty-five records of *Empidæ* with prey are tabulated below in the same manner as that adopted in the *Asilidæ*. More than half of these I owe to the skill and powers of observation of my kind friend Col. J. W. Yerbury, who also gave me the most valuable assistance in naming the Diptera—the captures of others as well as his own. The credit for this section of the Memoir belongs almost entirely to him.

SPECIES OF EMPID.	SPECIES OF PREY.	LOCALITY AND DATE.	OBSERVER.
HYBOTINÆ.			
227. *Hybos grossipes*, L., ♂. In Hope Dep.	A Psyllid (Homoptera) of the genus *Psylla*.	Tarrington, Herefordshire. Aug. 11, 1902.	J. W. Yerbury.
228. *Hybos grossipes*, L., ♂. In Hope Dep.	The Braconid, *Microplitis ocellatæ*, Bouché.	Tarrington, Herefordshire. Aug. 11, 1902.	J. W. Yerbury.
229. *Hybos grossipes*, L., ♂. In Hope Dep.	An Asilid (*Braconidæ*), in a condition which prevents determination.	Barmouth, N. Wales. Sept. 6, 1902.	J. W. Yerbury.
230. *Hybos grossipes*, L., ♂. In Hope Dep.	The Homopteron (*Typhlocybidæ*), *Typhlocyba quercus*, F.	Torcross, S. Devon. Aug. 9, 1903.	J. W. Yerbury.
231. *Hybos grossipes*, L., ♂. In Hope Dep.	A Mycetophilid fly of the genus *Sciara*.	Torcross, S. Devon. Sept. 6, 1903.	J. W. Yerbury.
232. *Hybos grossipes*, L., ♂. In Hope Dep.	The Mycetophilid fly, *Sciara* sp., ♂.	The Decoy, Newton Abbot, S. Devon. July 30, 1906.	A. H. Hamm.
233. *Hybos* sp.? *grossipes*, L., ♀. In Hope Dep.	The winged ant, *Myrmica rubra*, L., race *ruginodis*, Nyl., ♂.	Enfield, Middlesex. Sept., 1906.	C. J. C. Pool.
234. *Hybos femoratus*, Müll., ♀. In Hope Dep.	A minute Mycetophilid fly of the genus *Sciara*, ♂.	Tarrington, Herefordshire. July 22, 1902.	J. W. Yerbury.

SPECIES OF EMPID.	SPECIES OF PREY.	LOCALITY AND DATE.	OBSERVER.
HYBOTINÆ (*continued*).			
235. *Hybos femoratus*, Müll., ♂. In Hope Dep.	The Homopteron, *Typhlocyba flammigera*, Geoff.	Torcross, S. Devon. Aug. 10, 1903.	J. W. Yerbury.
236. *Cyrtoma spuria*, Fln., ♀. In Hope Dep.	The Bibionid fly, *Scatopse brevicornis*, Mg., ♂.	Torcross, S. Devon. Sept. 3, 1903.	J. W. Yerbury.
EMPINÆ.			
237. *Rhamphomyia dentipes*, Ztt., ♂. In Hope Dep.	The Ephemerid (May-fly), *Baëtis pumilus*, Burm., ♂. Fore-wings wanting, but one hind-wing and anal forceps enabled C. A. Briggs to determine the species.	Tarrington, Herefordshire. June 14, 1902.	J. W. Yerbury.
238. *Empis tessellata*, F. ? sex, specimens uncaptured.	The fly (*Sarcophaginæ*), *Onesia sepulchralis*, L.	Lodiswell, S. Devon. May 24, 1896.	J. W. Yerbury.
239. *Empis tessellata*, F. ? sex, specimens uncaptured.	The Leptid fly, *Leptis scolopacea*, L.	Lodiswell, S. Devon. May 24, 1896.	J. W. Yerbury.
240. *Empis tessellata*, F. ? sex, specimens uncaptured.	A Tipulid (Daddy-longlegs).	Lodiswell, S. Devon. May 25, 1896.	J. W. Yerbury.
241. *Empis tessellata*, F., ♂. In Hope Dep.	The Bibionid fly, *Bibio nigriventris*, Hal., ♂.	Tarrington, Herefordshire. May 28, 1902.	J. W. Yerbury.
242. *Empis tessellata*, F., ♂. In Hope Dep.	The Bibionid fly, *Bibio nigriventris*, Hal., ♂.	Tarrington, Herefordshire. June 2, 1902.	J. W. Yerbury.
243. *Empis tessellata*, F., ♂ and ♀ *in cop.*, ♀ with prey. In Hope Dep.	The Bibionid fly, *Bibio nigriventris*, Hal., ♂.	Tarrington, Herefordshire. June 5, 1902.	J. W. Yerbury.

244. *Empis tessellata*, F., ♂ and ♀ *in cop.*, ♀ with prey. In Hope Dep.	The Bibionid fly, *Bibio marci*, L., ♂.	Tarrington, Herefordshire. June 5, 1902.	J. W. Yerbury.
245. *Empis tessellata*, F., ♂. In Hope Dep.	The Leptid fly, *Leptis scolopacea*, L., ♂.	Malvern Hills. June 8, 1902.	J. W. Yerbury.
246. *Empis tessellata*, F. ? sex, specimens uncaptured.	The fly (*Sarcophaginæ*), *Onesia sepulchralis*, L.	Malvern Hills. June 8, 1902.	J. W. Yerbury.
247. *Empis tessellata*, F. ? sex, specimens uncaptured.	A species of *Tipula* (Daddy-longlegs).	Malvern Hills. June 8, 1902.	J. W. Yerbury.
248. *Empis tessellata*, F., ♂. In Hope Dep.	The Syrphid fly (*Volucellinæ*), *Volucella inflata*, F., ♂: a powerful and heavy insect for so slender a captor.	Tarrington, Herefordshire. June 18, 1902.	J. W. Yerbury.
249. *Empis tessellata*, F., ♂. In Hope Dep.	The Tipulid fly (Daddy-longlegs), *Tipula lunata*, L., ♂.	Ledbury, Herefordshire. June 21, 1902.	J. W. Yerbury.
250. *Empis tessellata*, F., ♀. In Hope Dep.	The Tachinid fly, *Aporomyia dubia*, Fln., ♂.	Pamber Forest, near Basingstoke. May 30, 1903.	H. St. J. K. Donisthorpe.
251. *Empis tessellata*, F., ♂. In Hope Dep.	The Dryomyzid fly, *Dryomyza* (*Neuroctena*) *anilis*, Fln., ♂.	Nethy Bridge, Spey Valley, Inverness. Aug. 5, 1904.	J. W. Yerbury.
252. *Empis tessellata*, F., ♂. In Hope Dep.	The Tipulid fly (Daddy-longlegs), *Tipula paludosa*, Mg., ♂.	Nethy Bridge, Spey Valley, Inverness. Aug. 5, 1904.	J. W. Yerbury.
253. *Empis tessellata*, F., ♂. In Hope Dep.	An Anthomyid fly of the genus *Hylemyia*, ♂.	Twitchen, Mortehoe, N. Devon. May 18, 1905.	G. B. Longstaff.
254. *Empis tessellata*, F., ♂. In Hope Dep.	The Bibionid fly, *Bibio marci*, L., ♂.	Twitchen, Mortehoe, N. Devon. May 19, 1905.	G. B. Longstaff.

SPECIES OF EMPID.	SPECIES OF PREY.	LOCALITY AND DATE.	OBSERVER.
EMPINÆ (*continued*).			
255. *Empis tessellata*, F., ♂. In Hope Dep.	The Bibionid fly, *Bibio marci*, L., ♂.	Twitchen, Mortehoe, N. Devon. May 20, 1905.	G. B. Longstaff.
256. *Empis tessellata*, F., ♂. In Hope Dep.	The Bibionid fly, *Dilophus febrilis*, L., ♀.	Twitchen, Mortehoe, N. Devon. May 26, 1905.	G. B. Longstaff.
257. *Empis tessellata*, F., ♂. In Hope Dep.	An Anthomyid fly of the genus *Mydæa*, ♂.	Twitchen, Mortehoe, N. Devon. May 29, 1905.	G. B. Longstaff.
258, 259, 260. *Empis livida*, L. Three ♂ specimens. Empids in Hope Dep.	The Tortricid moth, *Tortrix viridana*, L. Specimens not taken, but great numbers seen in the grasp of these Empids.	Bagley Wood, Oxford. July 4, 1897.	W. Holland and A. H. Hamm.
261. *Empis livida*, L., ♀. In Hope Dep.	The Borborid fly, *Borborus nigrifemoratus*, Mcq. The victim remains spitted on the proboscis of the Empid. The point has entered between the bases of the front coxæ and beneath the prosternum.	Boars Hill, Oxford. June 25, 1904.	A. H. Hamm.
262. *Empis livida*, L., ♂. In Hope Dep.	The Tortricid moth, *Tortrix viridana*, L.	Nr. Oxshott, Surrey. June 29, 1904.	W. J. Lucas.
263. *Empis livida*, L., ♂. In Hope Dep.	The Phryganid (Caddis-fly), *Lype phæopa*, Steph., ♀. Although the insect is in poor condition, K. J. Morton is satisfied with the identification.	Probably Somersetshire. Probably July, 1905.	E. Saunders.
264. *Empis livida*, L., ♂. In Hope Dep.	The Limnobid fly (*Limnobinæ*), *Dicranomyia dumetorum*, Mg., ♀.	Huntingfield, Kent. Evening, July 21, 1906.	H. St. J. K. Donisthorpe.
265. *Empis livida*, L., ♂. In Hope Dep.	The fly (*Muscinæ*), *Stomoxys calcitrans*, L., ♀.	Huntingfield, Kent. Evening, July 21, 1906.	H. St. J. K. Donisthorpe.

266. *Empis livida*, L., ♂. In Hope Dep.	A fly (*Anthomyinæ*) of the genus *Anthomyia*, ? sp., ♀.	Huntingfield, Kent. Evening, July 21, 1906.	H. St. J. K. Donisthorpe.
267. *Empis livida*, L., ♂. In Hope Dep.	A fly (*Anthomyinæ*) of the genus *Anthomyia*, ? sp., ♀.	Huntingfield, Kent. Evening, July 21, 1906.	H. St. J. K. Donisthorpe.
268. *Empis livida*, L., ♀. In Hope Dep.	The Anthomyid fly (*Cœnosinæ*), *Caricea tigrina*, F., ♂.	Huntingfield, Kent. Evening, July 21, 1906.	H. St. J. K. Donisthorpe.
269. *Empis livida*, L., ♀. In Hope Dep.	The Sepsid fly, *Sepsis cynipsea*, L., ♀.	Huntingfield, Kent. Evening, July 21, 1906.	H. St. J. K. Donisthorpe.
270. *Empis livida*, L., ♂. In Hope Dep.	The Sepsid fly, *Nemopoda cylindrica*, F., ♀.	Huntingfield, Kent. Evening, July 21, 1906.	H. St. J. K. Donisthorpe.
271. *Empis livida*, L., ♂. In Hope Dep.	The Crambid moth (Grass-moth), *Crambus hortuellus*, Hb., ♀.	Huntingfield, Kent. Evening, July 21, 1906.	H. St. J. K. Donisthorpe.
272. *Empis livida*, L., ♀. In Hope Dep.	The Crambid moth (Grass-moth), *Crambus*, sp. ? *pratellus*, Clk., ♀. Very much worn.	Huntingfield, Kent. Evening, July 21, 1906.	H. St. J. K. Donisthorpe.
273. *Empis livida*, L., ♀. ♂ and ♀ *in cop.*, ♀ with prey. In Hope Dep. except ♂ which escaped.	The Borborid fly, *Borborus equinus*, Fln., ♂.	Tabercoran, nr. Belfast. Aug. 9, 1906.	R. Shelford.
274. *Empis opaca*, F., ♂ and ♀ *in cop.*, ♀ with prey. In Hope Dep.	The Bibionid fly, *Bibio lacteipennis*, Ztt., ♂.	Brodie, Nairnshire. June 3, 1905.	J. W. Yerbury.
275. *Empis bilineata*, Lw., ♀. In Hope Dep.	The Bibionid fly, *Bibio lacteipennis*, Ztt., ♂.	Golspie, Sutherland. June 13, 1904.	J. W. Yerbury.
276. *Empis bilineata*, Lw., ♀. In Hope Dep.	The Empid fly, *Empis stercorea*, L., ♀.	Nairn. June 7, 1905.	J. W. Yerbury.

SPECIES OF EMPID.	SPECIES OF PREY.	LOCALITY AND DATE.	OBSERVER.
EMPINÆ (*continued*).			
277. *Empis grisea*, Fln., ♂. In Hope Dep.	The Anthomyid fly, *Pegomyia bicolor*, W., ♂.	Golspie, Sutherland. June 30, 1904.	J. W. Yerbury.
278. *Pachymeria femorata*, F., ♂. In Hope Dep.	An Anthomyid fly (*Mydæinæ*), of the genus *Hydrotæa*, ♂.	The Parks, Oxford. June 18, 1902.	A. H. Hamm.
***279.** *Pachymeria femorata*, F., ♂. In Coll. C. Morley.	The fly (*Therevidæ*), *Thereva bipunctata*, Mg., ♂.	Bramford, nr. Ipswich. July 8, 1904.	Claude Morley.
280. *Pachymeria femorata*, F., ♂. In Coll. C. Morley.	The fly (*Therevidæ*), *Thereva bipunctata*, Mg., ♂.	Bramford, nr. Ipswich. July 8, 1904.	Claude Morley.
281. *Pachymeria femorata*, F., ♂. In Coll. C. Morley.	The fly, *Thereva plebeia*, L., ♂.	Bramford, nr. Ipswich. July 8, 1904.	Claude Morley.
282. *Pachymeria femorata*. F., ♂. In Coll. C. Morley.	The fly (*Muscinæ*), *Myiospila meditabunda*, F.	Bramford, nr. Ipswich. July 8, 1904.	Claude Morley.
283. *Pachymeria femorata*, F., ♂. In Coll. C. Morley.	The Anthomyid fly, *Spilogaster duplicata*, Mg.	Bramford, nr. Ipswich. July 8, 1904.	Claude Morley.
284. *Hilara*, sp., ♀, condition too poor for determination. In Hope Dep.	The Chironomid fly, *Chironomus riparius*, Mg., ♀.	Tewkesbury. May 19, 1904.	H. St. J. K. Donisthorpe.

* **279.** Mr. Morley records that the *Pachymeria femorata*, observed on July 8, 1904, were flying in the hottest sunshine over grass along a hedgerow. All these *Empidæ* and their victims were named by Mr. G. H. Verrall. Mr. Verrall notes that *P. femorata* frequently hovers in a slow waving flight under lime trees in front of his house at Newmarket, always *in copulâ* and the ♀ with prey.

OCYDROMINÆ. **285**. *Ocydromia glabricula*, Fln., ♀. In Hope Dep.	A Mycetophilid fly, *Sciara*, sp., ♂.	Porthcawl, S. Wales. July 17, 1906.	J. W. Yerbury.
TACHYDROMINÆ. **286**. *Tachypeza nubila*, Mg., ♀. In Hope Dep.	A Cecidomyid fly of the genus *Cecidomyia*, ♂.	Tarrington, Herefordshire. June 6, 1902.	J. W. Yerbury.
287. *Tachydromia pallipes*, Fln., ♂. In Hope Dep.	A Braconid considered by Claude Morley to be the excessively rare *Liposcia discolor*, Marshall.	Ross, Herefordshire. June 19, 1902.	J. W. Yerbury.
288. *Tachydromia cursitans*, F., ♀. In Hope Dep.	A Mycetophilid fly of the genus *Sciara*, ♀.	Torcross, S. Devon. Aug. 24, 1903.	J. W. Yerbury.
289. *Tachydromia cursitans*, F., ♀. In Hope Dep.	A ♂ Empid fly of the same genus, *Tachydromia*, the condition such that G. H. Verrall cannot determine the species.	Tarrington, Herefordshire. July 11, 1902.	J. W. Yerbury.
290. *Tachydromia minuta*, Mg., ♂. In Hope Dep.	A minute Cynipid of the genus *Alloxysta*, Först., perhaps *A. forticornis*, Gir. (= *basalis*, Thoms.).	Porthcawl, S. Wales. June 22, 1906.	J. W. Yerbury.
291. *Tachydromia*, sp., ♀, condition prevents determination by G. H. Verrall. In Hope Dep.	An insect so fragmentary that determination is impossible.	Tarrington, Herefordshire. June 9, 1902.	J. W. Yerbury.

Nearly all the important conclusions to be drawn from the above records of *Empidæ* and their prey are shown in the table on pp. 386, 387. The whole of the *Empidæ* are included except the last-named—*Tachydromia* sp. (No. 291).

ANALYSIS OF THE PREY OF RECORDED SPECIES OF EMPIDÆ AND OF THE SEXES OF THE CAPTORS.

PREY OF EMPIDÆ.	EMPIDÆ.	HYBOTINÆ. *Hybos grossipes.*	*Hybos femoratus.*	*Cyrtoma spuria.*	EMPINÆ. *Rhamphomyia dentipes.*	*Empis tessellata.*	*Empis livida.*	*Empis opaca.*	*Empis bilineata.*	*Empis grisea.*	*Pachymeria femorata.*	*Hilara* sp.	OCYDROMINÆ. *Ocydromia glabricula.*	TACHYDROMINÆ. *Tachypeza nubila.*	*Tachydromia pallipes.*	*Tachydromia cursitans.*	*Tachydromia minuta.*	TOTALS.
NEUROPTERA.	*Ephemeridæ*				1													1
	Phryganidæ						1											1
HOMOPTERA.	*Psyllidæ*	1																1
	Typhlocybidæ	1	1															2
LEPIDOPTERA.	*Tortricidæ*						4											4
	Crambidæ						2											2
HYMENOPTERA.	*Cynipidæ*																1	1
	Braconidæ	2													1			3
	Formicidæ	1																1
DIPTERA.	*Cecidomyidæ*													1				1
	Mycetophilidæ	2	1										1			1		5
	Bibionidæ			1		7		1	1									10
	Chironomidæ											1						1

Limnobidæ						1											1
Tipulidæ					4												4
Leptidæ					2												2
Therevidæ										3							3
Empidæ								1							1		2
Syrphidæ					1												1
Tachinidæ					1												1
Sarcophagidæ					2												2
Muscidæ						1				1							2
Anthomyidæ					2	3			1	2							8
Dryomyzidæ					1												1
Sepsidæ						2											2
Borboridæ						2											2
TOTALS	7	2	1	1	20	16	1	2	1	6	1	1	1	1	2	1	64
SEXES. Males	6	1		1	12	11			1	6				1		1	40
SEXES. Females	1	1	1		3	5	1	2			1	1	1		2		19
SEXES. Unrecorded					5												5

Proportion of the Sexes.—In the recorded *Asilidæ* it was found (p. 359) that females with prey were between three and four times as numerous as males with prey. In the *Empidæ* tabulated above, such females are almost exactly half as numerous as males carrying prey. In spite of this great preponderance of the latter sex, females alone were found in 7 species, males alone in only 5, while 4 included both sexes. The large proportion of males is entirely due to their numbers in only 4 species out of the 15, viz. *Hybos grossipes*, *Empis tessellata*, *Empis livida*, and *Pachymeria femorata*.

Female Empidæ with prey captured in coitu.—This fact is recorded frequently in *Pachymeria femorata*,* twice in *Empis tessellata*, Nos. 243, 244, once in *E. livida*, No. 273, and once in *E. opaca*, No. 274. These instances out of 65 recorded cases form a much higher proportion than in the *Asilidæ*; but there are as yet no examples of the female attacking the male of its own species or of a remarkably cautious pursuit by the male during courtship, to support the interpretation which seems inevitable in the former group (see p. 367).†

The choice of Prey by Empidæ.—Only provisional conclusions can be reached in all the tabulated species except *E. tessellata*, with 20 records, and *E. livida* with 16. All others, except *Hybos grossipes* (7) and *Pachymeria femorata* (6), are hopelessly insufficient.

Hybotinæ.—The 10 records divided between three pairs, show an attack upon minute Homoptera, ants and *Braconidæ*; and the *Mycetophilidæ* and *Bibionidæ* among the Diptera.

Empinæ.—It is evident that Diptera form by far the most important insect food of this sub-family. In fact, we find no other prey, except in the case of *Rhamphomyia*

* *Vide* footnote on p. 384.

† Kirby and Spence were well acquainted with the facts recorded in the above paragraph, and make amusing suggestions as to their significance. Thus we read (5th edition, 1828, vol. i, pp. 274, 275):—"Many species also of *Empis*, whose haustellum resembles the beak of a bird, carry off in it *Tipulariæ* and other small *Diptera*; and what is remarkable, you can seldom take these insects in coitu, but the female has a gnat, some fly, or sometimes beetle in her mouth. Can this be to deposit her eggs in, as soon as they are impregnated by the male? or is it designed for the nuptial feast?" No Coleopterous victim of an Empid is recorded in the present Memoir. On the other hand, the predominance of Dipterous prey is abundantly confirmed.

dentipes attacking an Ephemerid, and *Empis livida*, the foe of *Tortrix viridana* and other small moths, also captured with a Phryganid. The 20 records of *Empis tessellata* —all Diptera—render it improbable that other insects are attacked.* The variety of prey within the limits of this Order is remarkable, no less than 8 families or sub-families being divided between the 20 victims. Of these the *Bibionidæ* (7) and to a far less extent the *Tipulidæ* (4) are responsible for more than half.

The 16 records of *Empis livida* include 6 moths (4 examples of *Tortrix viridana*, 2 of *Crambidæ*,) 1 Phryganid, and 9 Diptera, belonging to 5 different groups of which the *Anthomyidæ* furnish the largest number of victims (3). Of special interest in this species is the series of 9 examples (264–272) with prey captured by Mr. H. St. J. K. Donisthorpe at Huntingfield, Kent, on the evening of July 21, 1906. In circumstances such as these, when an abundant predaceous species is feeding in a locality where insects are common and varied, we obtain the most valuable information possible as to the range of its preferences. It is to be hoped that much time and labour will be directed to the collection of all possible material whenever such exceptionally favourable opportunities arise. The deeply interesting results of Mr. Donisthorpe's captures of *E. livida*, and of the two series of *Dasypogon diadema* (15–41 and 43–54) observed at nearly the same times at La Granja, indicate the importance and interest of the conclusions which may be thus reached.

The records of the other species of *Empinæ*, though quite insufficient in numbers, render it likely that their diet also is normally confined to Diptera of various groups.

Ocydrominæ.—The single example was found devouring a Mycetophilid.

Tachydrominæ.—Only 5 captures are recorded for 3 species. Of these 3 are Diptera (a Cecidomyid, a Mycetophilid, and an Empid), the 4th a minute Braconid, the 5th a minute Cynipid. The evidence is entirely

* It is pretty clear that the Rev. J. G. Wood was mistaken in speaking of *Empis tessellata* as the captor of *Tortrix viridana*. Thus he says :—"There are several species of this useful fly, one attaining some size ; but the one that claims our notice . . . is the little empis, scientifically called Empis tessellata." Now this latter is a large species, and Wood doubtless witnessed the attacks of the smaller *E. livida*. For the otherwise excellent popular account see "Common Objects of the Country," London, N. D., pp. 101, 102.

insufficient, but such as it is suggests that Diptera and minute Hymenoptera form the chief prey of this subfamily.

Summing up, we may conclude that with comparatively few exceptions the *Empidæ* are the foes of their own group,—the Diptera. In the vast preponderance of captures within the limits of a single Order, they are sharply contrasted with the *Asilidæ*.

C. Predaceous Diptera other than Asilidæ and Empidæ.

Although the following Diptera with insect prey belong to very different families the number of records is so small that it seems advisable to include the whole of the material (with the exception of two species considered separately at the close of this section) in a single tabular statement.

SPECIES OF DIPTERA.	SPECIES OF PREY.	LOCALITY AND DATE.	OBSERVER.
DOLICHOPODIDÆ.			
292. *Medeterus truncorum*, Mg. In Hope Dep.	A very minute species of Collembola, probably *Degeeria* sp., perhaps *D. cincta*, Lubb.	Tarrington, Herefordshire. Aug. 30, 1902.	J. W. Yerbury.
ANTHOMYIDÆ, *Cœnosinæ*.			
293. *Caricea tigrina*, F. In Hope Dep.	The Empid fly (*Tachydrominæ*), *Tachista connexa*, Mg., ♂.	Ross, Herefordshire. June 19, 1902.	J. W. Yerbury.
CORDYLURIDÆ.			
294. *Scatophaga suilla*, F., ♀. In Hope Dep.	The Limnobid fly, *Dicranomyia lutea*, Mg., ♂.	Aviemore, Spey Valley, Inverness. Aug. 17, 1904.	J. W. Yerbury.
295. *Scatophaga lutaria*, F., ♀. In Hope Dep.	The Anthomyid fly (*Mydæinæ*), *Mydæa urbana*, Mg., ♂.	Tarrington, Herefordshire. Aug. 8, 1902.	J. W. Yerbury.
296. *Scatophaga merdaria*, F., ♂. In Hope Dep.	The Tenthredinid (Saw-fly), *Taxonus glabratus*, Fln., ♀.	Tubney, nr. Abingdon, Berks. July 10, 1904.	A. H. Hamm.
297. *Scatophaga stercoraria*, L., ♀. In Hope Dep.	The Bibionid fly, *Dilophus febrilis*, L., ♂.	Wroxham, Norfolk. Sept. 5, 1902.	G. A. K. Marshall.

SPECIES OF DIPTERA.	SPECIES OF PREY.	LOCALITY AND DATE.	OBSERVER.
CORDYLURIDÆ (*continued*).			
298. *Scatophaga stercoraria*, L., ♂. *Scatophaga* in Hope Dep. Prey in Brit. Mus.	The fly (*Dexinæ*), *Macronychia viatica*, Mg., ♂. The victim was an addition to the list of British Diptera.	Porthcawl, S. Wales. June 12, 1903.	J. W. Yerbury.
299. *Scatophaga stercoraria*, L., ♂. In Hope Dep.	The fly (*Muscinæ*), *Stomoxys calcitrans*, L., ♀.	Torcross, S. Devon. Sept. 9, 1903.	J. W. Yerbury.
300. *Scatophaga stercoraria*, L., ♂. In Coll. C. Morley.	The Mycetophilid fly, *Sciara carbonaria*, Mg., ♀.	Foxhall, nr. Ipswich. Sept. 14, 1903.	Claude Morley.
* **301**. *Scatophaga stercoraria*, L., ♀. In Coll. C. Morley.	The Anthomyid fly, *Homalomyia canicularis*, L., ♂.	Ipswich. Sept. 18, 1903.	Claude Morley.
302. *Scatophaga*, sp., ♀, probably *stercoraria*, L.: very greasy. In Hope Dep.	A ♀ Limnobid fly, probably belonging to the *Eriopterinæ* and the genus *Erioptera*; legs and palpi wanting.	Black Pond, nr. Esher, Surrey. Sept. 20, 1903.	W. J. Lucas.
303 *Scatophaga stercoraria*, L., ♂. In Hope Dep.	The Syrphid fly, *Syrphus punctulatus*, Verr., ♂	Shotover Hill, Oxford. April 17, 1904.	A. H. Hamm.

* **301.** Mr. Claude Morley records the following details of the mode of attack:—"On observation I found the ♀ had bored a large hole in the back of the head of the ♂, and had sucked it quite dry; it now had its proboscis deeply inserted in the front of its victim's thorax and the action of absorption was easily seen." The *Scatophaga* was seated on a *Heracleum* flower in a garden at Ipswich.

Dolichopodidæ and *Anthomyidæ*.*—The single record of a victim captured by a species of each of these families will I trust be of value in calling the attention of naturalists to the fact that these flies are predaceous, and that specially directed observation will surely yield the material upon which to base a sound conclusion.

Cordyluridæ.—The fact that flies of the genus *Scatophaga* are predaceous is fairly well known, although the extent of their attacks is probably insufficiently recognized. We here find 10 records as the result of the observations of five observers in several very different British localities. The prey is remarkably scattered through varied Dipterous groups, as will be seen at a glance in the following table :—

The Prey of Scatophaga.

		Scatophaga suilla.	*Scatophaga lutaria.*	*Scatophaga merdaria.*	*Scatophaga stercoraria.*
HYMENOPTERA .	*Tenthredinidæ* .			1	
DIPTERA . . .	*Mycetophilidæ* .				1
	Bibionidæ . . .				1
	Limnobidæ . . .	1			1
	Syrphidæ . . .				1
	Dexinæ				1
	Muscinæ . . .				1
	Anthomyidæ . .		1		1
Totals . . .		1	1	1	7
Males				1	4
Females . . .		1	1		3

* Mr. G. H. Verrall informs me that all the *Dolichopodidæ* are predaceous. Only one sub-family of the *Anthomyidæ* is predaceous, namely, the *Cœnosinæ* which are closely allied to the *Cordyluridæ*.

The predaceous habits of the *Cordyluridæ* were well known to Messrs. Kirby and Spence :—

"Even *Scatophaga stercoraria* and *scybalaria*, and probably many others of the same tribe, feed upon small flies, though their proboscis does not seem so well adapted for animal as for vegetable food." *

The sexes of the captors are seen to be nearly evenly divided in the only record that is fairly complete; that of *S. stercoraria.* It is certainly remarkable that each of the 7 victims of this species should belong to a different family or sub-family of Diptera. The surprising example of a Tenthredinid victim (of *merdaria*) is of much interest, and prepares us for a wide variety of insect diet when naturalists have seriously turned their attention to the habits of the genus *Scatophaga.*

Ochromyia jejuna, F., Nos. 304–308.

The *Muscinæ* are not admitted among predaceous Diptera, the structure of the mouth-part being different from that in flies which attack and kill other insects. It is therefore of the utmost importance that any evidence which is held to prove the contrary opinion should be tested and sifted with far more than ordinary care.

During the past summer (of 1906) I received through the kindness of Mr. E. Ernest Green, a female example (304) of the abundant fly *Ochromyia jejuna*, together with a winged termite identified by Mr. W. F. Kirby as *Termes taprobanes*, Hg. The insects had been taken at Wellawaya, Ceylon, in November 1905, and Mr. Green described the termite as the prey of the Muscid. The observation is recorded in "Spolia Zeylanica" (see the number following date of capture). Colonel Yerbury, who determined the fly, was decidedly of the opinion that the observation was erroneous. I therefore wrote again to Mr. Green, and received the following reply :—"*Peradenyia, Ceylon, July* 17, 1906. The circumstances were as follows. I was personally working my moth-trap, which consists of a powerful acetylene lamp throwing its light on to a white cotton screen. Immediately after lighting up, the screen was covered with a crawling mass of winged termites. While watching these, I noticed the flies actually pouncing

* Fifth ed. 1828, vol. i, p. 275.

upon the termites. They did not attempt to carry them away, but fastened themselves on to the dorsum of the abdomen of each termite. There must have been some fifteen or twenty termites, each with its attendant fly. I very much regret that I did not bottle any of the couples alive and watch the subsequent proceedings. Instead of that I put them all into my poison bottle. Should the opportunity again occur, I shall pay closer attention to the actions of the fly. I think that the note in 'Journ. Bombay Nat. Hist.' (vol. xvi, No. 4, p. 747), to which I have already referred you, is a strong corroboration of the supposed fact, though we do not know for certain that the Indian fly was the same species as my Ceylon insect. I am writing to ask if specimens can be obtained for comparison."

In a few days Mr. Green obtained four of the specimens (305–308) referred to, and forwarded them to me, with the following letter:—"*Peradenyia, Ceylon, Aug.* 2, 1906. I am now able to send you some of the actual specimens that were the subject of the note in 'Journ. Bomb. Nat. Hist. Soc.' (vol. xvi, No. 4, p. 747). They have been received from the Secretary of the Society. They appear to be identical with or *very* closely allied to the flies taken by myself under similar circumstances, in Ceylon. These Indian flies are said to have been seen actually hawking the termites—on the wing. I think this is another sound link in the chain of evidence! I remember noticing particularly that the flies invariably attacked the *abdominal* part of the termite,—where the chitinous derm is thinner and softer than on the thorax."

The four specimens are all females of *Ochromyia jejuna*. They were captured by Capt. K. E. Nangle, 96th Berar Infantry, at Tarbund, Secunderabad, on July 17, 1905. Captain Nangle's note in the "Journ. Bomb. Nat. Hist. Soc." (vol. xvi, 1905, p. 747) is as follows:—"Last night after heavy rain there was a large flight of flying ants at about 9.30 p.m. After the swarm appeared we heard a loud humming noise and went out into the verandah to see what it was and found these flies in swarms. We at first thought from the noise, until we caught some, that it was bees swarming, although it was so late at night. We found these flies were hunting the flying ants, regularly hawking at them in the air. When a fly seized an ant it proceeded to devour the soft hind quarters."

"This swarm was noted all over our quarters: every house our Officers were present in at that time reported them."

"We none of us have ever come across a case like this during our service in the country. . . ."

Colonel Yerbury believes, from his knowledge of the fly, that it is erroneous to suppose that it actually hunts and kills living termites. He has written to me as follows upon the subject:—"*Oct.* 11, 1906. With reference to the *Ochromyia jejuna* question I can only reiterate my opinion that it is absolutely impossible for this fly to kill anything. All *Muscidæ* will go to moisture, and as winged termites come to grief in many ways, doubtless many a crushed termite attracts a muscid. The tongue of *O. jejuna* and *O. fuscipennis* is an extraordinary organ, but it is not that of a predaceous fly but more closely resembles that of *Glossina* without the piercing tip which the Tsetse flies possess. Possibly this is the explanation of my observation * in Ceylon of these flies taking away grains of sugar from large ants (*Lobopelta* and *Camponotus*), *i. e.* that the tongue acts as a suction pump—so when it is a case of 'pull devil, pull baker' between the fly and the ant the former gets the best of it."

If the opportunity should occur again, it is to be hoped that the flies may be subjected to a most minute and critical observation, in which special attention is directed to the tongue. If such examination should prove that *Ochromyia* is undoubtedly predaceous, we should be driven to suppose that the tongue contains some piercing instrument, undiscovered and concealed, or that the thin body-walls of the termite are penetrated by suction alone. The statement of these alternatives may serve as some slight guide to future observations.

The Prey of the Larval Syrphid Fly, Xanthandrus comtus, Harr., = *Melanostoma hyalinatum,* Fln., No. 309.

The preceding examples of predaceous Diptera have been confined to the perfect insect; but as the material for the present Memoir accumulated, I received an instance of

* Colonel Yerbury tells me that he observed this on the verandah of the Rest House, Kanthalai, Oct. 19, 1890.

a predaceous Dipterous larva of such special interest that I determined to include it.

Dr. T. A. Chapman ("Ent. Mo. Mag." 1905, pp. 150, 151; 1906, pp. 14–16) has observed the larva of *Xanthandrus comtus* feeding upon Tortricid larvæ, but only upon such as are gregarious or at any rate numerous upon their food plant. *Hastula hyerana* fulfilled this condition at Hyères, *Acroclita consequana* in Sicily, and a larva, probably of *Ancylis derasana* in the Alps: in all these cases Dr. Chapman found the larva of the Syrphid feeding upon that of the Tortricid. In Sicily *H. hyerana* occurred singly, and the Syrphid was not found attacking it. Dr. Chapman concludes from these instances that "*X. comtus* feeds especially on the larvæ of Tortrices when there are many on a plant," while "the isolation of the individual larvæ" renders them "an unsuitable prey for this parasite." The Syrphid larva would in fact "perish when it had destroyed its solitary prey and could find no others."

It is of the highest interest therefore to establish the fact, as Mr. G. T. Lyle of Brockenhurst has now done, that the larva of this species is found attacking single Lepidopterous larvæ when they are large enough to provide sufficient food.

In August 1903 Mr. Lyle found the full-fed Syrphid larva inside the shelter (constructed of sallow leaves loosely spun together) of the larva of the Geometrid moth, *Scotosia undulata.* Nothing remained of the latter except the dry and empty skin. The Syrphid larva was of a bright apple-green colour with darker markings. In September 1903 the perfect insect emerged. The specimen, together with the empty globular puparium,* was presented to the Hope Department by Mr. W. J. Lucas to whom Mr. Lyle had given it. The fly, a male (309), was kindly identified for me by Col. J. W. Yerbury.

Putting together Dr. Chapman's and Mr. Lyle's observations, there is reason for the opinion that the female Syrphid is instinctively led to deposit her eggs where there are either many minute larvæ or single larvæ of sufficient size. The adaptation to two different conditions under either of which sufficient food may be provided is of much interest, and it is to be hoped that further observations will be directed to the subject, so that

* See Dr. T. A. Chapman's description in "Ent. Mo. Mag." 1905, p. 151.

conclusions which at present seem to be justified may be confirmed or modified.*

The instincts of certain moths with phytophagous larvæ do not seem to be equally perfect. I have often observed, and every student of Lepidoptera must have noticed, that the large solitary larvæ of *Sphingidæ* are far more frequently found upon small bushes of their food-plant than upon large ones. It appeared to me that the explanation was to be found in the instincts of the parent moth leading her to deposit two or three eggs on each bush or tree, irrespective of size. If this were the case, the larvæ would of course be much easier to find and their effect upon the food-plant far more conspicuous upon the smallest bushes. However this may be, the parental instinct is certainly liable to error, for such large larvæ may occasionally be found still immature upon a bush so small that it has been completely denuded of its leaves.

II. NEUROPTERA.

Records of the attacks of predaceous insects are very scanty in all Orders except the Diptera and Fossorial Hymenoptera. It is hoped, however, that the following brief tabular statements will draw attention to the great need for a large body of accurate observations.

Leaving the Hymenoptera to form Part II of this Memoir, because of the voluminous literature and the fact that Fossors are predaceous in a somewhat peculiar and special sense, the remaining Orders are arranged in a succession determined by the number of records. The Neuroptera follow the Diptera, because the list of examples, although short, is longer than that of any except the two chief Orders.

* Compare Professor A. Giard's observation that the larvæ of *Melanostoma mellinum*, L., generally supposed to feed upon Aphides, can be reared upon *Musca domestica* and *Chortophila pusilla* (Bull. Soc. Ent. Fr. 1896, p. 234). Quoted in Verrall's British Flies, p. 303 (bottom line) and p. 311 (lines 12–17).

A. THE PREY OF ODONATA (DRAGONFLIES).

SPECIES OF ODONATA.	SPECIES OF PREY.	LOCALITY AND DATE.	OBSERVER.
310. *Sympetrum striolatum*, Charp., ♀. Specimen liberated.	Fly resembling a small Blow-fly, which flew away when Dragonfly was captured.	Kingston-on-Thames. Oct. about 19th, 1906.	W. J. Lucas.
311. *Libellula quadrimaculata*, L. Specimens untraced.	The small red Dragonfly, *Pyrrhosoma nymphula*, Sulz.	Black Pond, Esher Common, Surrey. June 21, 1896.	W. J. Lucas. Entom. 1897, p. 33.
312. *Cordulegaster annulatus*, Latr., ♀. In Hope Dep.	One of the "Common wasps," *Vespa rufa*, L., ☿. Wasp alive when specimens taken, but thorax crushed: sting protruding.	Queen's Bower, New Forest. Dragonfly settled on a dry branch. Aug. 6, 1898.	W. J. Lucas.
313. *Cordulegaster annulatus*, Latr., ♀. In Hope Dep.	The Tabanid fly (Horse-fly), *Tabanus græcus*, F., ♀: headless.	Peñalara, La Granja, Spain, about 7000 ft. July 25, 1902.	E. B. Poulton.
314. *Cordulegaster annulatus*, Latr., ♀. In Hope Dep.	The Malacoderm beetle, *Dascillus cervinus*, L., ♂.	Barmouth, N. Wales. June 29, 1902.	J. W. Yerbury.
315. *Cordulegaster annulatus*, Latr., ♂. In Hope Dep.	One of the "Common Wasps," *Vespa vulgaris*, L., ☿.	Blackwater stream, New Forest. July 30, 1906.	W. J. Lucas.
316. *Anax imperator*, Leach, ♂. Specimens untraced.	The much smaller Dragonfly, *Sympetrum scoticum*, Don. When captured the *Anax* abandoned its prey in the net. Held by the wings it seized with its legs and devoured another *S. scoticum* except the wings and part of abdomen.	Black Pond, Esher Common, Surrey. July 25, 1897.	W. J. Lucas. Entom. 1897, p. 281.

SPECIES OF ODONATA.	SPECIES OF PREY.	LOCALITY AND DATE.	OBSERVER.
317. *Æschna mixta*, Latr., ♂. Specimens untraced.	A Coccinellid beetle (Ladybird).	Black Pond, Esher Common, Surrey. Sept. 10, 1894.	W. J. Lucas. Entom. 1894, p. 350.
318. *Æschna cyanea*, Müll. Specimens untraced.	A small butterfly, probably the Lycænid, *Chrysophanus phlæas*, L. (Small Copper). The Dragonfly cut off the wings and when captured was eating the body.	Bagley Wood, nr. Oxford. Sept. 9, 1893.	W. J. Lucas. Entom. 1894, p. 87.
319. *Pyrrhosoma nymphula*, Sulz., ♀. In Hope Dep.	The Ephemerid (May-fly), *Ephemera danica*, Müll., ♂.	Aviemore, Spey Valley, Inverness. June 5, 1904.	J. W. Yerbury.
320. *Ischnura elegans*, Lind., ♀. Specimens not kept.	The Crambid (Grass-moth), *Crambus pascuellus*, L.	Hut Pond, nr. Wisley, Surrey. July 5, 1902.	R. South. Proc. S. Lond. Ent. Soc. 1903, p. 53.
321. *Agrion puella*, L., ♀. In Coll. C. Morley.	The Syrphid fly, *Platychirus manicatus*, Mg., ♀.	Walberswick marshes, Suffolk. July 28, 1896.	Claude Morley.
322. *Crocothemis erythræa*, Brullé, ♂. In Hope Dep.	The Galerucid beetle, *Exosoma pusilla*, Gerst. A fragment.	Salisbury, Mashonaland, 5000 ft. April 1, 1904.	G. A. K. Marshall.
323. *Orthetrum sabina*, F., ♂. In Hope Dep.	The Hesperid butterfly (Skipper), *Telicota bambusæ*, Moore, ♂.	Pulo Bidang, an island a few miles N. of Penang Island. Dec. 1, 1899.	Richard Evans.
323A. A very large red Dragonfly. Specimens uncaptured.	The Danaine Butterfly, *Limnas chrysippus*, L.	Estcourt, Natal, 4000 ft. Towards end of 1896.	G. A. K. Marshall. Trans. 1902, p. 329.
324. Odonates, one or more, not captured. Prey in Hope Dep.	The Termite (White Ant), *Eutermes* sp., ? *trinervis*, Ramb. Abdomen only eaten. The victims were found crawling on the ground. Three specimens.	Salisbury, Mashonaland, 5000 ft. Sunset, Nov. 12, 1903.	G. A. K. Marshall.

In addition to the above records W. L. Distant quotes the observation, made at Candahar, that Cicadas formed the prey of Dragonflies.*

Looking at the above list the most striking fact is the great variety of the prey and the marked inclusion of specially protected forms. The latter are as follows:—*Limnas chrysippus*, two common wasps (2 species) and three beetles belonging to distasteful groups, a Malacoderm, a Coccinellid, and a Galerucid. Thus specially protected species make up more than one-third of the 16 recorded captures, and include the whole of the Coleopterous victims. It is also of much interest to observe that a single species of Dragonfly, *Cordulegaster annulatus*, was responsible for both the wasps (Nos. 312, 315), and the Malacoderm (No. 314). The remaining victim of this species was a Tabanid fly (No. 313.)

As regards the ten species of prey which do not appear to belong to specially protected groups, we find 3 Diptera (1 Syrphid, 1 Tabanid, and 1 Muscid), 3 Lepidoptera (1 ? Lycænid, 1 Hesperid, and 1 Crambid), 4 Neuroptera (1 Ephemerid, 2 Odonata, and a Termite). Of the latter three specimens are only counted as one, inasmuch as the actual attack on these three victims was not witnessed and the number of individual foes is therefore unknown. Many Dragonflies, flying high, were seen attacking large numbers of Termites. It was of course impossible to determine whether these particular Termites had been seized by one, two, or three of their enemies.

The inclusion of 2 Dragonflies (Nos. 311, 316) among the prey shows that the attacks of Odonates, as in the case of so many other predaceous insects, do not altogether tend to the destruction of insect life; for here the predaceous forms themselves are the victims. The same considerations are suggested by the two species of *Vespa* devoured by *Cordulegaster annulatus*.

Short as it is, the list is extremely interesting, and raises the expectation that Dragonflies will be found to prey rather largely upon specially defended groups of insects.

* "Insecta Transvaaliensia," vii, 1906, pp. 169, 170.

B. THE PREY OF PANORPIDÆ (SCORPION-FLIES).

SPECIES OF PANORPA.	SPECIES OF PREY.	LOCALITY AND DATE.	OBSERVER.
325. *Panorpa meridionalis*, Ramb., ♂ ♀ ♀ viz. 3 out of about 18 specimens. In Hope Dep.	All surrounding a dead worm: about half were sucking it and none more than 6 inches distant from it.	Near Gimmelwald, on the road to Mürren, Bernese Oberland. July 12, 1898.	E.B.Poulton; confirmed by Mrs. Poulton and Miss Cora B. Sanders, F.L.S.
326. *Panorpa germanica*, L., ♀. In Hope Dep.	The Bibionid fly, *Bibio nigriventris*, Hal., ♀.	Cusop, Herefordshire. June 11, 1902.	J. W. Yerbury.
327. *Panorpa germanica*, L., ♂. In Hope Dep.	A ♂ Bibionid fly, probably *Dilophus febrilis*, L., but without the anterior legs.	Tewkesbury. May 17, 1904.	H. St. J. K. Donisthorpe.
328. *Panorpa germanica*, L., ♀. A beautiful nearly immaculate variety, nr. v. *borealis*. In Hope Dep.	The Empid fly, *Empis tessellata*, F., ♀.	Tongue, Sutherland. July, 1906.	E. A. Cockayne.
329. *Panorpa communis*, L., ♂. In Hope Dep.	One of the Telephorid beetles (Soldiers and Sailors), *Telephorus nigricans*, Müll., var. *discoideus*, Steph., ♂.	Tewkesbury. May 19, 1904.	H. St. J. K. Donisthorpe.
***330**. *Harpobittacus indicus*, Walk. Two examples. In Hope Dep.	The Pyralid moth, *Pagyda salualis*, Walk. One example.	Wellawaya, Ceylon. At night. Nov., 1905.	E. E. Green.

* **330.** The specimens, of which Mr. E. E. Green sent two and has retained others, were observed to be capturing and devouring small moths attracted by the light of a powerful acetylene lamp. The prey was caught and held with the third pair of legs. A note of the observation is published in "Spolia Zeylanica" (see the number following date of capture). Mr. W. F. Kirby informs me that at least up to 1892 and probably up to the present time, no example of the *Bittacidæ* has been recorded from Ceylon. Two species are known from India, viz. *Harpobittacus indicus*, Walk., and *Bittacus latipennis*, Gerst; and one from Shanghai:—*B. sinensis*, Walk. Mr. E. E. Green's specimens appear to be indistinguishable from the first-named which is known to occur in S. India.

In addition to the above records Kirby and Spence quote Lyonnet's observation of a *Panorpa* attacking a Dragonfly many times its size.*

This brief list of the attacks made by *Panorpidæ* contains facts of much interest. The crowd surrounding a dead worm (No. 325) seems to prove beyond doubt that the Panorpas had been attracted by smell. The insects had congregated round the worm in a sheltered position on a roadside bank. The Telephorid victim (No. 329) is a striking example of specially protected prey; while the Empid (No. 328) and the Dragonfly recorded by Lyonnet show that predaceous insects are attacked as well as others. It must be borne in mind however that the first record (No. 325) strongly suggests, although it does not prove, that these insects devour dead prey. The record of actual capture and the condition of the victim become therefore of special interest and importance in the *Panorpidæ.*

III. HEMIPTERA.

Considering the immense number of predaceous species included in the Hemiptera the following table is insignificant. I trust however that it may lead to abundant future observations on which trustworthy conclusions may be based.

So far as it is possible to judge from the following table it appears that Hemiptera will prove to be extremely dangerous foes to the specially protected groups. Thus out of 15 victims, we find 3 Lepidopterous larvæ (Nos. 331, 333, 337) all probably defended by special qualities; 2 stinging Hymenoptera (Nos. 335, 338); 2 Phytophagous beetles (Nos. 332, 345) and a Cetoniid (No. 334); 2 Hemiptera (Nos. 341, 342);—altogether no less than two-thirds of the total records. The remaining five examples include a Lycænid butterfly, 2 Longicorn beetles of one species, and 2 Diptera. Even among these the conspicuous colouring of the beetle suggests the probability of special defence.

* Kirby and Spence, 5th Ed. 1828, vol. ii, p. 253.

THE PREY OF HEMIPTERA.

SPECIES OF HEMIPTERON.	SPECIES OF PREY.	LOCALITY AND DATE.	OBSERVER.
PENTATOMIDÆ.			
331. *Picromerus bidens*, L., ♀. Pentatomid in Hope Dep.	Found on and apparently eating the dead larva of *Bombyx rubi*, L. (Fox moth).	By roadside, near Hincheslea, New Forest. July 30–Sept. 3, 1904.	W. J. Lucas.
332. Pentatomid larva, probably of *Podisus luridus*, F. In Hope Dep.	The Chrysomelid beetle, *Phyllodecta vitellinæ*, L.	Battle, Sussex. Aug. 6, 1905.	H. St. J. K. Donisthorpe.
***333**. *Podisus luridus*, F., larva. In Hope Dep.	The mature or nearly mature larva of the Lymantrid moth, *Orgyia antiqua*, L.	Wilverley Enclosure, New Forest, Hants. Aug. 16, 1906.	G. T. Lyle.
†**334**. *Euthyrrhynchus floridanus*, L. Recorded as *Pentatoma punicea*, by Belt.	"A bright green rose-chafer" (*Cetoniidæ*).	Nicaragua. From "The Naturalist in Nicaragua," Lond., 2nd Ed. 1888, pp. 127, 128.	Thomas Belt.
REDUVIIDÆ.			
335. *Harpactor iracundus*, Scop., ♀. In Hope Dep.	The bee, *Halictus scabiosæ*, Rossi, ♂, typical.	Between Soller and its Port, Majorca. July 4, 1901.	E. B. Poulton.
336. *Harpactor iracundus*, Scop., ♀. In Hope Dep.	The Lycænid butterfly (Hairstreak), *Thecla ilicis*, Esp., ♂, type form.	Near Car Terminus, Montserrat, near Barcelona, about 3000 ft. July 14, 1901.	W. Holland.

* 333. The captor with its prey was beaten off oak. Undisturbed by the shock the bug was still sucking the caterpillar when it fell into the beating-tray, and continued to do so for an hour, by which time its victim appeared to be quite flaccid. Mr. Lyle informs me that he has commonly observed such Hemipterous larvæ devouring caterpillars in the New Forest, but that he has never seen one before with prey of so large a size.

† 334. Twice observed as the victim of the much smaller and less active bug. Belt suggests that the Pentatomid inserts its proboscis and poisons the beetle while sleeping. W. L. Distant quotes Belt's observation and points out that the correct name of the Pentatomid is *Euthyrrhynchus floridanus* (Biol. Centr. Am. Rhynch. Het., vol. i, 1880–1893, p. 42.

337. *Harpactor iracundus*, Scop., ♀. In Hope Dep.	The larva of the Noctuid moth, *Cucullia lychnitis*, Ramb.	La Granja, Spain, about 4000 ft. July 22, 1902.	Monsieur Chretien.
338. *Harpactor iracundus*, Scop., ♀. In Hope Dep.	The bee, *Halictus mucoreus*, Ev., ♀.	La Peñalara, La Granja, Spain, about 7000 ft. July 29, 1904.	T. A. Chapman.
339. *Harpactor iracundus*, Scop., ♀. In Hope Dep.	The Longicorn beetle (*Cerambycidæ*, *Lepturinæ*), *Leptura melanura*, L., ♂.	Casayo, S.E. of El Barco, N.W. Spain. July 2–9, 1906.	T. A. Chapman.
340. *Harpactor erythropus*, L., ♀. In Hope Dep.	The Longicorn beetle, *Leptura melanura*, L., ♂.	S. Geronimo, near summit of Montserrat, near Barcelona, about 4000 ft. July 15, 1901.	E. B. Poulton.
341. *Coranus subapterus*, De G. In Coll. C. Morley.	The Lygæid bug, *Trapezonotus agrestis*, Fln.	Under a stone, Lakenheath Warren, Suffolk. Aug. 27, 1900.	Claude Morley, E. M. M. 1900, p. 288.
342. *Nabis lativentris*, Boh. (= *apterus*, D. & S.), larva. In Hope Dep.	The Capsid bug, *Plagiognathus arbustorum*, F., ♀. The Capsid immensely larger than the Reduviid larva.	Chale, Isle of Wight. July 24, 1906.	H. St. J. K. Donisthorpe.
343. *Nabis limbatus*, Dahlb., ♂. In Hope Dep.	The Opomyzid fly, *Opomyza germinationis*, L.	Woodhay, near Newbury, Berkshire. Aug. 9, 1906.	H. St. J. K. Donisthorpe.
CAPSIDÆ. **344**. A larva. In Hope Dep.	A Chironomid fly of the genus *Cricotopus*, probably *C. sordidellus*, Ztt., probably ♂. Fragmentary.	The University Parks, Oxford, June 24, 1905.	A. H. Hamm.
NOTONECTIDÆ. **345**. *Notonecta glauca*, L. Specimen uncaptured.	The Phytophagous beetle, *Donacia vulgaris*, Zsch. Specimen taken but escaped.	Sutton Broad. June 9, 1906.	H. St. J. K. Donisthorpe.

IV. ORTHOPTERA.

Although the predaceous Orthoptera are so well known to all naturalists who have visited the tropics, I have been able to find very few precise records of their attacks in the wild state. I do not of course include in this Memoir any of the results obtained by experiments, a fine series of which, conducted by Mr. G. A. K. Marshall, upon *Mantidæ*, will be found recorded in Trans. Ent. Soc. Lond. 1902, pp. 297–315; 316–319. As a matter of fact I have not been able to find so many exact observations upon the predaceous habits of the *Mantidæ* as upon those of the *Locustidæ*, a group often assumed to be entirely plant-eating.

The meagre records of predaceous Orthoptera are set forth below in a tabular form.

THE PREY OF MANTIDÆ AND LOCUSTIDÆ.

SPECIES OF ORTHOPTERA.	SPECIES OF PREY.	LOCALITY AND DATE.	OBSERVER.
MANTIDÆ.			
346. *Sphodromantis*, sp. probably *gastrica*, Stål, immature ♀. In Hope Dep.	The Lycænid butterfly (Blue), *Myrina ficedula*, Trim., probably ♂. Abdomen and right hind-wing.	Salisbury, Rhodesia, 5000 ft. Jan. 28, 1906.	G. A. K. Marshall.
347. *Gongylus gongyloides*, L. Specimens uncaptured.	The Pierine butterflies, *Delias eucharis*, Drury (several times); and *Belenois mesentina*, Cr.; and the Hesperid (Skipper), *Hasora alexis*, F.	On flowers of *Duranta* sp., Trinkomali, Ceylon. 1890–1891.	J. W. Yerbury. Trans. 1902, p. 316.
348. *Creobotra urbana*, F., ♂. Mantid in Hope Dep.	The Pierine butterfly, *Delias descombesi*, Boisd.	On a *Lantana* bush, North Shan States, Upper Burma. Oct. 9, 1900.	C. T. Bingham. Trans. 1902, p. 316.

349. *Mantidæ*, an undetermined species. Specimens uncaptured.	The Acræine butterfly, *Acræa horta*, L., ♂. The Mantis ate the abdomen and a little of the thorax and then threw the butterfly away.	Karkloof, Natal. Feb., 1897.	G. A. K. Marshall. Trans. 1902, p. 318.
LOCUSTIDÆ.			
350. *Acanthoplus pallidus*, Walk., ♂. In Hope Dep.	The larva of the Danaine butterfly, *Limnas chrysippus*, L.	Salisbury, Rhodesia, 5000 ft. April 2, 1904.	G. A. K. Marshall.
351. *Hemisaga prædatoria*, Dist.	The Danaine butterfly, *Limnas chrysippus*, L.	Transvaal. Undated.	W. L. Distant. "Naturalist in the Transvaal," 1892, p. 65.
352. *Locusta viridissima*, L., ♀. In Hope Dep.	A Noctuid moth, almost certainly *Caradrina ambigua*, F., ♀. Abdomen, right hind-wing and third legs only.	At "sugar," Ilsham Drive, nr. Torquay, S. Devon. Aug. 12, 1900.	A. H. Hamm.
***353**. *Locusta viridissima*, L., ♀. Specimens uncaptured.	The Noctuid Moth, *Xylophasia polyodon*, L.	The Sandhills, Deal (on the top of a sugared post). August, 1888.	G. T. Porritt. Proc. Sect. D., Brit. Assoc., York, 1906.
354. A Locustid about the size of *L. viridissima*. Specimens uncaptured.	The Acridian (grasshopper), *Gomphocerus sibiricus*, L., var.	Nr. Weisshorn Hotel, above Vissoye, Val d'Anniviers, Switzerland, 7690 ft. Aug.–Sept., 1895.	E. B. Poulton. Trans. 1902, p. 329, where the prey is unnamed.

*353. Mr. G. T. Porritt has kindly supplied me with further details. He writes, Oct. 31, 1906:—"Just as I threw the light of the lantern on the post, the *polyodon* came up, and was at once seized, to my great astonishment, as up to then I had regarded these Locustids as strict vegetarians! Scores of times since then I have seen these Orthoptera in such situations on the South Devon coast as well as at Deal, but, as it is comparatively rarely that a moth will alight on the sugar under the glare of a lamp, I have not again seen one devoured in this way. The fact that *L. viridissima* does visit posts for such purposes is well known and has been seen over and over again by those who sugar on the sandhills regularly. I alluded in my paper on Melanism [Sec. D., Brit. Assoc., 1906] to this Locustid occurring in very large quantities on the thistle-heads on a marshy part of the Deal sandhills, last year (1905). I have no doubt that this was with the same object of obtaining food. I have seen them in the same way on nettles. The flowers of both these plants are very attractive to moths at times, and I am convinced that this is one of the ordinary methods of *L. viridissima* for obtaining its food." [See also No. 352.]

In addition to the above, Mr. W. L. Distant draws attention to the records of Cicadas attacked by species of *Mantis* at Delagoa Bay and in the Transvaal.*

Although the evidence is so inadequate, it presents indications that conclusions of much value will be reached by extended observations. In the first place, the whole of the victims except one were Lepidopterous. In the second place, the proportion of specially protected forms was very high. Thus a *Delias* was attacked twice, an *Acræa* once, *Limnas chrysippus* once in the imaginal and once in the larval state. In respect of the attacks on such forms no distinction can be drawn between the *Mantidæ* and the *Locustidæ*. We are led to believe that the predaceous Orthoptera are important foes of those Lepidoptera that are specially defended from vertebrate insect-eaters.

V. COLEOPTERA.

The following brief list is chiefly useful in drawing marked attention to the urgent need for observations with full and accurate data. The experiments of Professor F. Plateau (Mém. Soc. Zool. Fr. t. vii, p. 375, § 9: see also Trans. Ent. Soc. Lond. 1902, p. 330) suggest that predaceous beetles are probably important foes of specially protected insects. These experiments are not quoted on the present occasion inasmuch as the Coleoptera were fed in confinement. The present Memoir deals only with the prey selected by predaceous forms in the wild state.

It must be remembered that beetles are frequently scavengers rather than truly predaceous. Thus the observation of an actual capture becomes of especial value. In the following list the two flies had certainly fallen into the water, and No. 357 may have been drowned before it was seized. The *Agabus*, No. 356, and Elaterid, No. 362, were certainly attacking living prey.

* "Insecta Transvaaliensia," Pt. vii, 1906, pp. 169, 170.

PREDACEOUS COLEOPTERA AND THEIR PREY.

CICINDELIDÆ. **355.** *Mantichora mygaloides*, Thoms.	The Cicada, *Callipsaltria longula*, Stål.	Rustenburg, Transvaal. Undated.	W. L. Distant. "Insecta Transvaaliensia," vii, 1906, p. 178.
DYTISCIDÆ. **356.** *Agabus chalconotus.*, Panz., ♂. In Hope Dep.	The living Empid fly, *Empis tessellata*, F., ♂. The fly was also being eaten by another *A. chalconotus* which escaped.	A pool in Ramnor Enclosure, New Forest. June 19, 1906.	J. J. Walker.
GYRINIDÆ. ***357.** *Gyrinus natator*, Scop., ♂. In Hope Dep.	The Cordylurid fly, *Scatophaga merdaria*, F.	Belvedere, near Woolwich, N. Kent. April 2, 1905.	J. W. Yerbury.
STAPHYLINIDÆ. †**358.** *Ocypus olens*, L., ♂. In Hope Dep.	The Carabid beetle (Ground-beetle), *Pterostichus madidus*, F	Probably Reigate, Surrey. Undated.	Edward Saunders.
HISTERIDÆ. **359.** *Hister caffer*, Erichs. Specimens uncaptured.	The Coprid beetle, *Onitis alexis*, Klug: far larger than its captor.	Salisbury, Mashonaland, 5000 ft. About 1898.	G. A. K. Marshall. Trans. 1902, p. 331.
360. *Hister caffer*, Erichs. Specimens uncaptured.	Aphodiid beetles.	Salisbury, Mashonaland, 5000 ft. About 1898.	G. A. K. Marshall. Trans. 1902, p. 331.
LATHRIDIIDÆ. **361.** *Melanophthalma (Corticaria) fuscula*, Mannh. In Coll. C. Morley.	A Thrips (Thysanoptera), perhaps *Coleothrips fasciata*, L.	On the wall of outhouse, The Hill House, Monks' Soham, Suffolk. March 19, 1905.	Claude Morley.
ELATERIDÆ. **362.** *Corymbites virens*, Schr., ♀. In Hope Dep.	The caterpillars of the Nymphaline butterfly, *Vanessa urticæ*, L.	Mountain road from Gemmi Pass to Leuk, about 6000 ft. July 19, 1898.	E. B. Poulton. Trans. 1902, p. 331.

* 357. The fact that *Gyrinus* is predaceous was known to Kirby and Spence. Thus we read in the 5th Ed. 1828, Vol. I, pp. 271, 272 :—"Most of the aquatic beetles, at least the Gyrini and Dytisci, prey upon other insects both in their first and final state."

† 358. The head of the *Pterostichus* is still projecting from the mouth of the *Ocypus* as though the prey had been swallowed entire. It is however probable that the appearance is deceptive and that the Carabid was devoured piecemeal, the head last.

XIX. *Entomological Observations and Captures during the visit of the British Association to South Africa in* 1905. By F. A. Dixey, M.A., M.D., F.E.S., *and* G. B. Longstaff, M.A., M.D., F.R.C.P., F.E.S.

[Read June 5th, 1907.]

Plate XXV.

Cape Town.

Lat. 34° S. Sea level. August 8th, 1905.

Surely no one who was on deck when the "Kildonan Castle" anchored in Table Bay will forget the impressive scene. Behind the town-lights which gleamed along the front the grand mass of Table Mountain, clear cut against a streak of dawn, lay under the Southern Cross and Magellanic Clouds, while in the opposite quarter Jupiter and Venus shone brilliant beyond our experience, the latter reflected in the sea, and Orion standing on his head demonstrated that we were indeed in a Southern land. These astronomical facts had a bearing on our entomological operations, since we had to grow accustomed to the fact that the most promising hunting-grounds were slopes with a *north-east* aspect.

Faithful to our own science rather than to the association of which we were members, we had decided to go on to Durban by the same steamer, and put in as many days collecting as possible on the Natal Coast. This left us but a day and a half at Cape Town, in which to get a glimpse of its fauna and flora, and we were truly fortunate in that the Southern spring smiled upon us and provided, if indeed few insects, at any rate what Mr. Boswell would have termed "some fine prospects."

We were aware of the poverty of the Cape Peninsula in Rhopalocera, and Mr. L. Péringuey, the obliging director of the South African Museum, impressed the fact upon our minds, yet we were hardly prepared to find butterflies so scarce as in fact we did.

The best scheme seemed to be to drive to Camps Bay, stopping on the way to collect on the slopes of the Lion's Head, above Sea Point. While waiting for the carriage

we took in the garden of the Mount Nelson Hotel, on narcissus flowers, a few honey-bees, *Apis mellifica*, Linn., of the somewhat brighter race *adansonii*, Latr., that is common throughout South Africa, and with them their familiar mimic *Eristalis tenax*, Fabr. An *Empis* was also common in the garden.*

The country had all the appearance of early spring, and it was evident enough that we were much too early for good sport. Below the Lion's Head, by a little stream perhaps 200 feet above sea-level, we took two specimens of the brownish Lycænid *Cacyreus palemon*, Cram., quite unlike any "Blue" that either of us had previously seen alive; these and a Skipper that eluded us at Camps Bay were the only butterflies we saw that day.

Turning over stones proved disappointing; besides sundry scorpions and myriapods the chief tenants were ants, a larger yellowish species, *Camponotus maculatus*, Fabr., and a smaller black species, *Acantholepsis capensis*, Meyr. With the ants were a few beetles, such as two specimens of *Formicomus cæruleus*, an Anthiid, *Microlestia tabida*, Fabr., another beetle not yet determined, and two larvæ of a *Lampyris*.

Along with the beetles were sundry cockroaches, creatures we were afterwards to find numerous; among them were two *Deropeltis juncea*, Sauss., and immature examples of *Blatta orientalis*, Linn.

The best harbour for insects appeared to be a species of *Solanum*, a medium-sized, prickly shrub bearing numerous seed-capsules. On this plant the red Lady-bird *Chilomenes lunata*, Fabr., was abundant, also a black species, *Chilocorus* sp., unrepresented in the National Collection, was fairly common. Several other Lady-bird-like beetles, as yet undetermined, were found on the same plant, as well as one specimen of *Epilachna hirta*, Thunb. (the sole phytophagous genus in a family otherwise carnivorous). On the leaves were also two examples of the tiny *Abacetus minutus*, Dej.

A dark-green, scarlet-striped bug, *Lygæus festivus*, Thunb., accompanied the Lady-birds, while immature specimens of

* The original idea was to allude to every insect seen by us in our rush through South Africa, but at the time of going to press many species, especially among the *Orthoptera*, *Diptera*, and *Lepidoptera-Heterocera*, were still undetermined, and so for the most part are not mentioned.

the same were common inside the seed-vessels together with numbers of a fetid brown bug not yet named and what we took to be beetle larvæ. A third bug, of a pale scarlet colour when alive, frequented the same *Solanum.*

The few flowers that were out yielded nothing but a honey-bee and an *Empis* sp.

At Clifton, Camps Bay, on the under-cliff above the dazzling white beach, we took off the flowers of a shrubby *Senecio*-like Composite the small green Longicorn, *Promeces linearis,* Linn., the small bronzy bee, *Halictus jucundus,* Smith, ♀, and *Apis mellifica,* 2 ☿.

A small Carabid, *Platynus rufipes,* Dej., found under a stone, completed our short list. As we often experienced afterwards, the South-east Trade brought up clouds and gave us a dull afternoon, so that collecting was practically over at an early hour.

Port Elizabeth, Algoa Bay, Cape Colony.

Lat. 34° S. Sea level. August 11th.

The steamer did not give us a very long time at this place. After an early breakfast we took the train to Zwaartkops, some seven miles to the northward.

The coast here is flat and fringed with sand-hills; by the railway the country is sandy and heathy; on the south side of the river its delta forms a level plain perhaps a mile wide between the sand-hills and the railway, this is diversified by brackish swamps and intersected by streams. On the drier portions of this plain Termitaria are numerous, from 1 foot to 2½ feet high, and 2 to 3 feet across; they are smooth and hard on the surface as if " rendered " with cement, many-chambered within. One long ridge of sand was covered with thorny shrubs. The most conspicuous plant was a tall *Aloe* (? *arborescens,* ? *ferox*), 6 or 8 feet high in full flower, but there were also at least two species of *Cotyledon* [*Echeveria*], and several species of *Mesembryanthemum.* Low growing *Euphorbias* were many and varied, one appeared to be absolutely stemless. There was also an ivy-leaved *Pelargonium.* A fresh easterly breeze swept over the open ground and added much to the difficulty of catching butterflies.

The males of *Synchloë hellica,* Linn., were rather common, flying fast, but occasionally settling; four specimens were secured. Of *Leuceronia buquetii,* Boisd., at least three

were seen, two were secured, both males, but a third managed to get out of the net; they flew strongly. The proboscis of this butterfly when fresh is of a bright green colour like its eyes. On the other hand, *Colias electra*, Linn., was more restrained in its movements, and two males were taken. Of *Pinacopteryx charina*, Boisd., several were seen, also two or three individuals of an orange-tipped *Teracolus*, probably *omphale*, Godt.

On the lee side of bushes which afforded a slight shelter, the Lycænid, *Leptomyrina lara*, Linn., was common, taking short flights and settling on the ground or on low plants. Nearer the sea on a sunny bank under the lee of the sand-hills, the very beautiful and singular Lycænid *Phasius thysbe*, Linn., was not uncommon, though apparently very local; it has a quick skipping flight and time allowed the capture of but two males and a female. In the same locality a pretty little rose-coloured Geometer, *Sterranthia plectaria*, Guen., was fairly common, but unfortunately only two specimens were brought away. On the open plain the familiar and cosmopolitan *Nomophila noctuella*, Schiff., was often disturbed and two were taken, as well as a specimen of the scarcely less widely distributed *Phlyctænia ferrugalis*, Hübn.

A piece of rough heathy ground near the railway-station yielded two Satyrids, *Pseudonympha sabacus*, Trim., and others were seen near the same spot; the genus is characteristic of South Africa. Close by a small Blue *Zizera lysimon*, Hübn., was netted, as well as a fine variety of *Sterrha sacraria*, Linn.

Under some planks lying on the sand of the river bank we found among smaller bugs, our first specimens of *Physorhynchus crux*, Thunb. This large Reduviid, whose wings are so closely appressed to the abdomen that we for some time took it to be apterous, is very conspicuous when alive, the pale testaceous thorax and margins of the abdomen showing up the black cross upon its back, but the pale portions soon darken and the insect is dingy in the cabinet.

Turning over stones produced a few beetles: single examples of *Lycanthropa synœcoides*, Ques., *Harpalus exiguus*, Dej., and *Blenosia* [*Blacodes*] sp., as well as two *Trigonopus* sp., the last two both represented at South Kensington, but unnamed. With the beetles were several *Blattidæ*, *Deropeltis erythrocephala*, Fabr., ♀, an immature

Cosmozosteria sp., and three specimens of another *Blatta* which stands unnamed in the National Collection.

An old termitarium, long abandoned by its builders, afforded asylum to a number of insects, among which the most numerous and most conspicuous was the large Carabid *Microlestia rugoso-punctata*, Thunb.; there was also a solitary weevil, *Hipporrhinus appendiculatus*, Gyll.

The great spikes of Aloe proved attractive to flies and a bee, *Prosopis sandaracata*, Bingh. At the same flowers a long-tailed bird was very busy, but whether catching bees or eating honey could not be made out.

The Hopliine beetle *Gymnoloma atomaria*, Fabr., was taken on a flower. Among flies the cosmopolitan genus *Sarcophaga* was represented, and what would appear to be a *Dysmachus* was noted to settle on the ground.

While searching for beetles it was impossible to overlook the numerous empty spires of the large and handsome snail, *Achatina zebra*, Chem. [=*fulgurata*, Pfr.]; one of them was tenanted by a stump-tailed lizard. A couple of tortoises added to the picture.

[Among the small bees that we brought home was a small one (unfortunately not labelled) that was in all probability taken at Zwaartkops, though possibly at Cape Town, which turns out to be a new species, *Halictus inornatus*, Bingh. Its description, with those of other *Aculeata* taken by us in South Africa, will be included in a paper to be presented to the Society very shortly.]

East London, Cape Colony.

Lat. 33° S. Sea level. August 12th.

An eager reconnaissance from the deck before breakfast revealed a tempting spot a mile or two to the north-east of the town where hills of blown sand capped by scrub suggested many possibilities. Accordingly we landed at the earliest opportunity and took a carriage. The road from the quay in the inner harbour brought us in a very few minutes into the Queen's Park, through which we were to drive. Our attention was at first caught by the weird forms of gigantic tree-Euphorbias, but these were soon forgotten, for as we passed the park gates we seemed to enter a very preserve of butterflies. To one of us the sight was new as it was beautiful, to the other it brought back vivid recollections of India and Ceylon; both agreed

to dismiss forthwith the Kaffir driver, who doubtless, while he pocketed his easily-earned fare, pondered on the strange results of European civilization and the increase of lunacy consequent thereon.

The park is formed out of a piece of the primæval scrub of varied growth, filling a horseshoe-shaped hollow between the town and a tributary of the Buffalo. It is intersected with roads, footpaths, and streams; in parts are artificial shrubberies and flower-beds, which are gradually ousting the natural scrub. In the varied scene of insect life the most obvious characters were clouds of *Mylothris agathina*, Cram., of both sexes, their brilliant white and orange colouring showing clearly as they fluttered slowly and fearlessly over the large bushes of Poinsettia [*Euphorbia pulcherrima*] glowing with their scarlet bracts. The males give out a strong scent very closely resembling that of sweet-briar. Amongst the *agathina* we took three specimens of the nearly allied *rüppellii*, Koch, of both sexes, and in another part of the Park a single male of the delicate *trimenia*, Butl., with its pale yellow hind-wings.

Less showy, but almost equally common, was *Belenois severina*, Cram., the "common white" of this part of the world. Both sexes were well represented, the male having a distinct scent. All were of the dry-season form; some were very small. Of *B. gidica*, Godt., a single male was taken, also strongly scented.* Of the more gaudily coloured *B. zochalia*, Boisd., two males and a female turned up.

Terias was represented by a single *brigitta*, Cram., a male; *Colias* by two *electra*, Linn., also males; and *Teracolus* by two *omphale*, Godt., one of each sex. Last, but not least beautiful of the Pierines was *Eronia cleodora*,† Hübn., of which five specimens were taken, while a male *E. leda*, Dbl., was netted, but it managed to get away.

The widely-ranging *Limnas chrysippus*, Linn., of the typical African colouring, which, as is well known, is darker than in the Indian form, was flying slowly about in some numbers; two *females* that were taken yielded the "musk-rat" odour.

* On the subject of scents in South African butterflies, see Dixey, Proc. Ent. Soc. Lond., 1905, pp. liv–lix, and *ibid.* 1906, pp. ii–vii.

† It is well known that the local races of *E. cleodora* show great differences in the amount of black bordering to the wings. This in the East London specimens is reduced to a minimum. See Dixey, Proc. Ent. Soc. Lond., 1905, p. lxvi.

Another butterfly that was very common was the Nymphaline, *Eurytela hiarbas*, Dru. It has a curious slow gliding flight backwards and forwards about bushes, for flowers seem to have no attraction for it; but if the flight of this butterfly, and its coloration, brown with a transverse white band, remind one of the *Neptis* group, its general appearance and shade-loving habits suggest a Satyrid. *E. hiarbas* orients itself with tail to the sun, but not very accurately. Conspicuous amongst the Nymphalines was our old friend *Pyrameis cardui*, Linn., mostly in poor condition, but one very fine. The large genus *Precis* was represented by three species, *sesamus*, Trim., *archesia*, Cram., and *cebrene*, Trim., the latter not uncommon. One specimen of each was secured, but we had our first lesson in the elementary fact that to see a *Precis* is not always the same thing as to catch it.

A sunny bank cleared of scrub was grown over with a *Senecio* not unlike the Oxford *squalidus*, Linn. Amongst these flowers *Byblia goetzius*, Herbst, was rather common; they often settled on the ground; they were all females, one of "intermediate" character, the rest "dry." A single *B. ilithyia*, Dru., was "very dry." This and a specimen taken at Ladysmith were all of this species that we saw in South Africa.

One of the spots in the park where butterflies were especially numerous was a sunny bank close to an open drain whose black stream evolved so much sulphuretted hydrogen as to suggest pollution by a laundry. Some Poinsettia bushes (including one with the bracts pale yellowish instead of the more usual scarlet), growing where the smell was most sickening, proved quite as attractive to butterflies as others in sweeter situations.*

A few fine blue and black Papilios dashed about to tantalize us (they were almost certainly *P. nireus*, Cram., f. *lyæus*, Dbl.), but the common South African *P. demodocus*, Esp., proved much easier to capture, and between the Park and the town two specimens fell victims to our nets; one of them seemed to have been injured by a bird.

* This reminded me of a part of "The Happy Valley" at Hong Kong (in 1904), so fouled with human excrement that collecting was difficult, yet clouds of butterflies fluttered about the flowers of *Lantana camara*, Linn., growing around. There was no evidence that the insects were attracted by the ordure, but they were certainly not repelled. It is well known that *Charaxes* is a foul feeder. —G. B. L.

Satyrids were conspicuous by their absence. A single female specimen of the common dingy South African skipper, *Gegenes zetterstedti*, Wallgr. (= *hottentota*, Latr.) was the sole Hesperid seen, but the Lycænids were better represented by a solitary male of the far-ranging *Tarucus telicanus*, Lang, and several specimens of the "amphisbaenoid" tailed and lobed Blue, *Argiolaus silas*, Westw. This has a rapid and jerky flight and is fond of settling high up, so that the observation of its "false head" and its attitude at rest was attended with difficulty, but a male and four females were easily taken off the red blossoms of a tall shrub.

The only moth taken was the day-flying Lymantriad, *Euproctis mesozona*, Hmpsn., a male; this is a species represented in the National Collection solely by the type.

Among other orders the *Diptera* were represented by an *Idia* and another fly; we did not take a single beetle, being indeed too busy with the butterflies. There were many small grasshoppers in the coarse grass by the foul stream, the most striking being the common South African *Catantops melanostictus*, Schaum, whose red tibiæ and striped femora render it conspicuous. The only Aculeate taken was a worker *Belonogaster praunsi*, Kohl, one of two seen on the same plant. This genus, very characteristic of the country, has an extremely long peduncle to the abdomen. A specimen of the Sawfly *Athalia himantopus*, Klug, a species that Col. Bingham says is widely spread over the African continent, was taken. The bug *Atelocera stictita*, Westw., was caught flying: during life its underside is covered with a white waxy substance.

Among the things that we saw that morning, but did not catch, were a *Charaxes*, an *Amauris* (probably) and *Atella phalanta*, Dru.

Durban, Natal.

Lat. 29° 50′ S. Sea level. August 13–21.

At Durban we had the great advantage of an introduction to Mr. A. D. Millar. This gentleman and the members of his family are enthusiastic entomologists. It had been our intention to go northwards and explore the country about the mouth of the Tugela, but, acting on Mr. Millar's advice, we decided to stay in Durban and so make the best use of our time, which was here, as elsewhere, all too short.

The Ocean View Hotel in the residential suburb called THE BEREA is perhaps 200 feet above the sea; its garden yielded a few of the commoner butterflies—*Papilio dardanus,* Brown, a male, *Precis clelia,* Cram., *Mycalesis safitza,* Hew., both sexes, and *Zizera lucida,* Trim., a male.

Lanes and bits of open ground near the hotel, still retaining much of the character of the primæval scrub, afforded fair collecting. It was in such a place that we were much excited at beating out our first *Salamis anacardii,* Linn., a large greenish nymphaline very leaf-like on the under-side and with a peculiar satiny sheen that gives it a very tropical aspect. There we found late in the afternoon both sexes of *Limnas chrysippus,* Linn.; with them were less familiar butterflies, *Acræa terpsichore,* Linn. (=*buxtoni,* Butl.) several (they feigned death in the net); *A. cabira,* Hopff., one; a pair of *Precis sesamus,* Trim.; an example of *Eurytela hiarbas,* Dru.; also several specimens of *Byblia goetzius,* Herbst, of both sexes, all more or less "dry" in character; this butterfly flies rather quickly low down and settles usually on the ground under a bush, but is easily disturbed. We also took at the Berea two males of *Belenois severina,* Cram.; two males and a female of *Mylothris agathina,* Cram.; and one of each sex of *Terias regularis,* Butl. Of smaller things we took one each of *Zizera lysimon,* Hübn., and *Gegenes zetterstedti,* Wallgr., and beating produced a Geometer, not yet identified.

The glow-lights of the Hotel only yielded the Boarmid *Tephrina arenosa,* Butl., and two Noctuæ:—*Ophiusa mejanesi,* Guen. (a moth that occurs in India, coming very near to Walker's type of *expedita,* a species sunk by Sir George Hampson), and *Eulaphygma micra,* Hmpsn. A humble fly, *Homalomyia canicularis,* Linn., was an inmate of the Hotel.

Sandy banks by the roadside were haunted by various Fossors, two of which, *Liris hæmorrhoidalis,* Fabr., a male, and *Pompilus diversus,* Smith, a female, exhibit Lycoid coloration, the last-named more especially with its yellow-brown wings tipped with black. With these were two *Dielis fasciatella,* Hübn., both males. The Syrphid fly, *Eristalis tæniops,* Wied., was too handsome to be passed by.

The first of his favourite localities to which Mr. Millar directed us was the old Cemetery at SYDENHAM. About three miles to the north of Durban, it lies on the north (sunny) side of a hill sloping very gradually towards the

Umgeni River, and may be some 400 feet above sea level. The Cemetery itself is neglected and overgrown with coarse grass and herbage, which doubtless nourishes many larvæ, while there are enough flowers to attract butterflies. The grassy lanes on either side afford excellent collecting ground, and, although most of the land around is cultivated, there is some scrub to the south.

Here we found, besides our familiar friend *Limnas chrysippus*, Linn., our first specimens of *Amauris albimaculata*,* Butl., both males. Single specimens of the beautiful dark red *Acræa petræa*, Boisd., and of *A. natalica*, Boisd., a male, were taken. The fore-wings of the last-named are when the insect is fresh of a fine rose-crimson, the hind part of the abdomen (in the male) being banded above with pale rose-pink and white, but white beneath. Males of *A. terpsichore*, Linn., were fairly common, especially among dead grass. *A. encedon*, Linn., of which two examples were taken, was so successful in its mimicry of *L. chrysippus*, as at first to make one of us believe it to be that species.

In the Cemetery a few males of *Hypolimnas misippus*, Linn., were sailing around, flying high and seldom flapping their wings, but no females were observed. In an open space within the enclosure, as well as in a cleared mealy-field adjoining, *Precis clelia*, Cram., was locally common, settling on the bare earth and on the grave-stones; with them were a couple of *P. cebrene*, Trim., but that species was commoner in the dry bed of a spruit half-a-mile to the north; some of the specimens were very small. Three examples of *P. natalica*, Feld., were taken; *P. sesamus*, Trim., was not uncommon. Only two *Catacroptera* [*Precis*] *cloantha*, Cram., were seen, one of them in the dry spruit. *Eurytela hiarbas*, Dru., was very common about hedgerows. Single specimens of *Pyrameis cardui*, Linn., and *Salamis anacardii*, Linn., turned up. Several male specimens of *Byblia goetzius*, Herbst, were taken, but it was hardly common. *Charaxes varanes*, Cram., required considerable negotiation to effect its capture, as its flight is both high and strong, but it has a habit of settling at the end of a prominent twig, and is then fairly easily detected in spite of the resemblance of its under-surface to a leaf.

Of *Mycalesis safitza*, Hew., two females were taken, one

* For the specific distinctness of this form from *A. echeria*, Stoll, see Rothschild and Jordan, *Novit. Zool.* x, 1903, p. 504.

near the Cemetery, the other in the village of Sydenham (a mile nearer Durban), they were flying in full sunshine in the early afternoon. Of *M. perspicua*, Trim., three males were taken among dry grass, etc., near the before-mentioned spruit, they were rather common there but of restless habits, so that it was very difficult to see them settle. It was interesting to find that on separation of the wings and stroking the patch near the costa of the hind-wings they gave out a very strong scent quite distinct in character from that of *M. safitza*, Hew., which last has one of the strongest scents met with.

Of *Belenois severina*, Cram., a male was taken; but *B. gidica*, Godt., appears to have been commoner, since three males and a female were brought home. Three *Pinacopteryx pigea*, Boisd., two males and a female (near Sydenham village), and one *P. charina*, Boisd., were taken. We met with but one *Mylothris agathina*, Cram., a male, but *Eronia leda*, Dbl., was not uncommon, flying rapidly along a lane near the Cemetery, often in company with *Teracolus auxo*, Luc.; it was hard to catch, but three males and a female were secured. The genus *Teracolus* was more dominant at Sydenham than at any other locality which we visited, the most abundant species (especially in fields) was *T. auxo*, Luc. (the dry form called by Wallengren *topha*). The males appeared to outnumber the females by two to one. On one occasion a specimen of *auxo* and one of *Eronia leda*, both males, were in the net together, they were duly pinched and as the net was lying open on the ground another *auxo* (sex not known) came and settled on it close to the dead butterflies! The next commonest species was *T. annæ*, Wallgr. (dry-season phase, = *wallengrenii*, Butl.), of which thirteen males and one female were taken. On the other hand, of *T. omphale*, Godt., we took but three males and one female, and of *T. achine*, Cram., a like number, while of *T. phlegyas*, Butl. [according to Trimen = *ione*, Godt.], we secured but a single male, of which it was noted that the purple tip was not apparent in flight. Butterflies of the genus *Terias* were in abundance locally, the specimens brought home proved to be *T. regularis*, Butl., four males (one of them "intermediate" in character, the rest dry), and *T. senegalensis*, Boisd., one male (dry). The only other Pierine taken was *Colias electra*, Linn., on the road about a mile on the Durban side of the Cemetery; the species was not common.

One *Papilio dardanus*, Brown, was taken at Sydenham, but *P. demodocus*, Esp., was common; it flew fast but generally not very high, twice at least it was observed to flutter its wings when feeding, as its congener *P. erithonius*, Cram., [= *demoleus*, Linn,] has been observed to do in India. A specimen taken in Sydenham village was very small.

A considerable variety of Lycænids was taken, though they cannot be said to have been abundant: *Virachola antalus*, Hopff., a male; *Hypolycæna philippus*, Fabr., a female; *Axiocerces harpax*, Fabr., a male settled on a rose-bush in the Cemetery; *Lycæna bœtica*, Linn., one; *Zizera lucida*, Trim., two females; *Z. lysimon*, Hübn., one on the way; *Lachnocnema bibulus*, Fabr., four, in the Cemetery, this species sits with the abdomen turned up at an angle of 45° (like *Euchloë*); *Catochrysops malathana*, Boisd. (= *asopus*, Hopff.); while on the slopes of the spruit before mentioned was taken a single example of *Alæna amazoula*, Boisd., a female; this last was very cryptic when among the grass where it was found. In general appearance it so closely resembles a tiny *Acræa* that at first it was placed next to that genus.

The Skippers again were varied rather than numerous, single specimens being taken of each of the following:—*Sarangesa motozioides*, Holland, almost invisible as it sat on a rock in the spruit with its wings spread out flat; *Netrobalane canopus*, Trim., resting with expanded wings on the upper side of a *Solanum* leaf; *Baoris fatuellus*, Hopff.; *Gomalia albofasciata*, Moore; the large species *Rhopalocampta pisistratus*, Fabr., and *R. forestan*, Cram.; lastly *Caprona adelica*, Kirsch, a prettily marbled butterfly with a scaleless patch on the fore-wing, of which there are but two specimens in the British Museum.

The Syntomids *Pseudonaclia puella*, Boisd.; *Syntomis simplex*, Walk., two, a metallic-blue thing easily caught; and *Euchromia formosa*, Guér., were taken flying, the latter near the spruit. A crippled specimen of the singular Geometer, *Cænina pœcilaria*, H.-S., was taken in the Cemetery, a better one missed in the spruit, both among long grass.

The following *Hymenoptera* were taken: *Xylocopa divisa*, Klug, a male; a grey wasp, *Icaria cincta*, Lepel., ☿; the ant *Camponotus maculatus*, Fabr., eight specimens under a stone; and an undetermined Ichneumon.

The great order *Coleoptera* was very poorly represented

by two Lady-birds, *Ortalia* sp., beaten out of a composite creeper (apparently a *Senecio*), the species is represented in the British Museum, but unnamed; three *Haplolycus*, apparently of two species [one possibly *congener*, Gerst.], were either beaten out of, or taken flying about the same creeper; *Acantholycus constrictus*, Fabr., was caught flying slowly; two specimens of *Anomalipus porcatus*, Sol., were found under a stone; and four specimens of a Heteromeron were also found under stones, *Opatrum* sp., apparently in the National Collection, but unnamed.

The bugs, at least as regards individuals, were somewhat more plentiful; beating the climbing composites (one with yellow, another with lavender flowers) revealed a number of the fetid Pentatomid *Antestia variegata*, Thunb., at first taken by both of us to be Lady-birds; two other fetid Pentatomids, *Holcostethus goniodes*, Dall., and *H. scapularis*, Thunb., were also taken.

There were two as yet undetermined Acridians among our captures as well as the common *Catantops melanostictus*, Schaum. Also a Dragonfly, *Orthetrum fasciolatum*, Ramb.

The Botanical Garden lies on the slope of the hill between the Berea and the Race-course, and comprises portions of the original scrub, so that it naturally harbours many butterflies. Amongst these was a small female of *Limnas chrysippus*, Linn., which was actually mistaken by one of us for its mimic *Acræa encedon*, Linn., of which three specimens were captured. A single specimen of *Planema esebria*, Hew., and two of *Acræa cabira*, Hopff., were netted, one of the latter settled on a leaf with wings closed was inconspicuous. Of *Amauris albimaculata*, Butl., a male and two females were taken, one of the latter settled near the ground before 9.0 a.m., at which time it was noticed that Skippers were especially active.

Eurytela hiarbas, Dru., was common in the wooded parts of the garden, where also three *Precis elgiva*, Hew., were secured, together with two *P. natalica*, Feld., of the dark, or intermediate form (one very tattered), sitting on leaves with wings fully spread. The same bit of surviving scrub yielded two of the Satyr-like *Crenis boisduvalii*, Wallgr., one of each sex. *Neptis agatha*, Cram., was not uncommon, but as the garden is a good deal exposed to the prevalent south-east wind many of the specimens were worn. *Salamis anacardii*, Linn., was beaten out at

4.45 p.m., it had a very slow flight. Of *Byblia goetzius*, Herbst, we took a male of the dry form. In a shady spot were two *Melanitis leda*, Cram., the only specimens that we met with in South Africa. *Mycalesis safitza*, Hew., with its *janira*-like flight, was not uncommon in the shade, the four specimens taken in the gardens were all females of the dry-season form (var. *evenus*, Hopff.).

Belenois severina, Cram., was common; though the large majority were dry, amongst them was found a semi-wet male. It was noted of a pair *in cop.* that the male supported the female in flight. Only one *B. gidica*, Godt., a male, was taken. But if not quite the commonest white of the gardens, certainly *Pinacopteryx pigea*, Boisd., was the most characteristic; a dozen specimens, both sexes about equally balanced, were secured, they were all of the dry form (= *alba*, Trim.); it appeared to be an earlier riser than many butterflies. A pair were observed *in cop.*, the male supporting the female and when settled enclosing the female between his wings. Of *P. charina*, Boisd., two of each sex were taken, one of the females was less dry than the rest. *Mylothris agathina*, Cram., was scarcely common, males prevailing. In the more open grassy parts a few *Teracoli* were to be got: of *T. speciosus*, Wallgr., we took two males; *T. omphale*, Godt., was commoner, and we took five males and two females; of *T. achine*, Cram., one of each sex. Of *Eronia cleodora*, Hübn., we took but one; *Terias regularis*, Butl., was common enough, six specimens taken proved to be all females, of the dry form. We did not meet with this species outside Natal.

Just outside the northern hedge of the Botanical Garden a fine *Papilio morania*, Ang., was taken flying low along with *Belenois severina*, Cram., and settling on wayside plants; others of the genus were *P. demodocus*, Esp., a male; *P. dardanus*, Brown, two males, a species that does not fly as fast as many of its congeners; *P. nireus*, Cram., f. *lyæus*, Dbl., a male and two females.

The *Lycænidæ* were conspicuous by their scarcity, only two being met with—*Hypolycæna philippus*, Fabr., a male taken as late as 5.0 p.m., and *Zizera lysimon*, Hübn., two, one of them beaten out but little earlier (together with two *P. pigea* and two *B. severina*).

But if Blues were scarce it was far otherwise with Skippers: of our old friend *Gegenes zetterstedti*, Wallgr., seven were taken, five being males, two females; this sits

in the familiar "skipper attitude" but the posterior third of the hind-wing is plaited; *Baoris fatuellus*, Hopff., one; *Acleros mackenii*, Trim., seemed to be common but was hard to catch, a male only was netted; of *Pterygospidea* [*Tagiades*] *flesus*, Fabr. [= *ophion*, Dru.], five specimens were secured; it has a rapid darting flight, dashing wildly up and down the glades like a flash of silver, and suddenly settling with wings widely spread like a *Boarmia*, usually (so far as our experience went) on the *upper* side of a leaf, though it was on at least one occasion seen to settle on the *under* side, which Mr. Trimen gives as its habit; the fine large skipper *Rhopalocampta keithloa*, Wallgr., rests in a singular attitude, the wings are raised above the back but do not meet, since both primaries and secondaries are

Rhopalocampta keithloa. Position of wings in resting attitude, seen from behind.

curved outwards somewhat spirally, moreover the posterior half of the secondaries is curiously plaited over the abdomen; a specimen of *R. forestan*, Cram., was beaten out as late as 4.45 p.m., darting away with a whirligig flight.

The Lymantriad moths *Euproctis punctifera*, Walk., three males, and *E. stellata*, Dist., two males, were beaten out one afternoon, together with the Larentid Geometer, *Epirrhoë subspissata*, Warr., one; the Acidalids *Craspedia pulverosaria*, Walk., and *Idæa spoliata*, Walk., one of each; the Deltoids *Hypena thermesialis*, Walk. [= *Ophiuche masurialis*, Guen.] three; the Pyrales *Bradina* [*Erilita*] *admixtalis*, Walk., one; *B.* [*Physematia*] *atopalis*, Walk., two; and some others not yet determined.

Two beetles only were captured, one the weevil *Stramia anconifrons*, Boh.; the other, *Cardiophorus* sp., was found under an old tarpaulin.

The sole Aculeate brought away was a beautiful light blue bee, *Crocisa picta*, Smith, ☿, which with its rapid flight suggested a small dragon-fly.

Three species of Diptera were met with: *Eristalis tæniops*, Wied.; *Syrphus ægyptius*, Wied.; and *Sarcophaga* sp.

A solitary Pentatomid bug, *Agonoscelis versicolor*, Fabr., was taken.

Of dragon-flies we took one of a species not yet determined, and two that would appear to be *Orthetrum fasciolatum*, Ramb.

In approaching Durban from the sea one first sights THE BLUFF, a ridge of high ground separating the harbour from the Indian Ocean. Access is obtained on the landward side by a steep path, the resort of many butterflies, being protected from the sea winds and lying fully open to the sun. It is at first hard to realize that south of the Equator hill-sides with *northern* aspects are the most likely hunting grounds for butterflies. At the eastern extremity, near the lighthouse, the Bluff is more or less bare; but the path towards the west soon leads into the scrub, or natural forest, of mixed growth with a scarcely penetrable undergrowth of the coarse Acanthaceous plant called by the natives "u-Bomaan." Through the scrub there has been cut a very wide road, grass-covered, which keeping parallel to the coast, runs up hill and down dale for at least a couple of miles, how much further we had not time to investigate. This road with its occasional glimpses of the sea, perhaps 150 or 200 feet below, afforded the most delightful collecting ground imaginable. One was constantly reminded of ridings through woods in Southern England, but rudely brought back by catching the net in the well-concealed thorns of the familiar "fern-asparagus" of our hot-houses and dinner-tables [*Asparagus ? plumosus*], or by a glimpse of the dusky form of a cryptically-coloured Kaffir in the gloomy shadow of the forest. But everything has its drawbacks; that of the Bluff was climatic, for all too soon after mid-day, on both our visits, the south-east Trade-wind freshened and great clouds rolling up from the Indian Ocean sent all well-regulated butterflies to bed.

Limnas chrysippus, Linn., was very common, especially towards the more civilized end of the road. *Planema esebria*, Hew. (curiously enough the only species of the Acræine group that we saw there), has a flight of moderate rapidity, but two were easily caught. Several *Atella phalanta*, Dru., were seen and a few netted. *Precis* was represented by a single *clelia*, Cram.

Eurytela hiarbas, Dru., was present but not common; of *Byblia goetzius*, Herbst, two were taken, one of them less "dry" than usual. *Salamis anacardii*, Linn., with its slow flight, looked strangely smaller than it is; it soon settled on a leaf and appears indeed to be a very sluggish insect. Two females of *Mycalesis safitza*, Hew., are recorded from the Bluff.

By far the predominant butterfly was *Belenois severina*, Cram., which was very abundant; the males largely exceeded the females in numbers, but a good many of the latter were seen. Though the very large majority were of the dry type, intermediate examples were also present. They appeared to be markedly gregarious, though this may have been due to the distribution of their favourite flowers. Two pairs were observed *in cop.*, in each case the female, hanging down impassive, was carried by the male. Of *B. gidica*, Godt., which was far less common, we took two males and three females. Most of this species were seen near the bottom of the path leading from the harbour up to the lighthouse. Of *B. thysa*, Hopff., we took two males; when on the wing they were very like the male of *Mylothris agathina*, Cram., in flight and general aspect. Indeed even as seen in the net the *Belenois* so closely mimics the *Mylothris* that one of us though specially on the look-out was deceived, and this even when the two insects were taken the same morning.

Pinacopteryx charina, Boisd., was decidedly common, but the sexes were very unequally distributed; we took 17 males to 2 females. One male specimen had lost the anal angles of the hind-wings, probably from the bite of a lizard. Of *Glutophrissa saba*, Fabr., a male was taken. The beautiful *Eronia cleodora*, Hübn., was quite common; we took 18 specimens which appear to be mostly males; it flies fast. The Plate accompanying this paper gives a fair idea of the brilliance of the butterfly and the conspicuous arrangement of its strongly contrasted colours, but it shows far more satisfactorily its cryptic coloration when resting, as it was several times observed by us, upon or close by yellow, blotched and perforated leaves of the *u-Bomaan*, as the Kaffirs call the shrub forming the bulk of the undergrowth on the Bluff. This plant, now known as *Isoglossa woodii*, Clarke [figured in J. Medley Wood's "Natal Plants," vol. i, Plate XXII, under the name of *Ecteinanthus origanoides*, T.], belongs to the natural order

Acanthaceæ, and is not the food plant of the larva.* The under-side of the hind-wing of the butterfly varies almost as much as the discoloured leaves, and the resemblance is general, that is to say, it is not a definite case of leaf-imitation. It should be noted that a coloured sketch of the leaves was made at the time, but in the absence of the butterfly, to avoid any tendency to exaggerate the resemblance. Mr. H. Knight's drawing is quite admirable.

Of *Teracolus achine*, Cram., we took a male; of *T. omphale*, Godt., two of each sex; but we naturally paid more attention to the beautiful "Purple-tips," *Teracolus speciosus*, Wallgr. [Butler named the dry form of this butterfly *jobina*, and considered the wet form to be the *ione* of Godart.] This was not uncommon, and we secured six males and two females; during its flight, which is rapid, it looks like an ordinary white, the purple not showing on the wing.

Of *Terias regularis*, Butl., we took a male, and of *T. senegalensis*, Boisd., a female, both dry.

We managed to get two specimens of *Papilio policenes*, Cram., but one of them was sadly battered; also one male of *P. dardanus*, Brown, f. *cenea*, Stoll; a specimen of *P. nireus*, Linn., f. *lyæus*, Dbl., was easily secured flying low down when a cloud passed over the sun.

Curiously enough we took but a solitary Blue, *Virachola antalus*, Hopff.†

Single specimens of the Skippers *Gegenes zetterstedti*, Wallgr., a female; *Gomalia albofasciata*, Moore, and *Baoris fatuellus*, Hopff., were taken, the last named settled on a leaf in the sun, with the wings fully expanded; also two *Kedestes macoma*, Trim.

We kicked up from grass, etc., two specimens of the exceedingly variable Noctua *Ophiusa lienardi*, Boisd., one of them settled upon the ground; in like manner we turned up a battered example of the restless Noctua *Remigia repanda*, Fabr., and found another at rest upon a leaf in the full sun. Here we took our first specimen of that beautiful Catocaline, the steel-blue and orange yellow

* Some further particulars were given when attention was first called to the matter. See Longstaff, Trans. Ent. Soc. Lond. 1906, pp. 113, 114; but the Plate was not ready in time to be issued with that paper.

† See Longstaff, *Some Rest-Attitudes of Butterflies*, Trans. Ent. Soc. Lond. 1906, p. 108.

Egybolia vaillantina, Stoll, known to the Colonists as the "Peach Moth." Also the Arctiid *Rhanidophora cinctigutta*, Walk., and the curious Geometer *Cartaletis libyssa*, Hopff., of which several were seen, but only one taken. It flies rather high with feeble fluttering action, and when on the wing somewhat recalls *Limnas chrysippus*, or an *Acræa*, which last it also resembles by exuding a yellowish juice when pinched, the juice in this case being odourless. Another Geometer, allied to our "Magpie-moth," was *Zerenopsis geometrina*, Feld.

The familiar *Phlyctænia ferrugalis*, Hübn., completes the list of moths, so far as we have been able to assign them names.

The yellow and chocolate-coloured Lamellicorn *Macroma cognata*, Schönh., was very conspicuous on the wing; the Clavicorn *Episcaphula aulacochiloides*, Crotch, was taken under a log, associated with ants and fungi. *Asida bicostata*, Fåhr., and *Hister subsulcatus*, Mass., were also found under logs; a specimen was obtained of the Phytophagous Lady-bird, *Epilachna infirma*, Mulsant. The weevil *Sciobius pullus*, Sparr., a female, was beaten out of a clematis-like creeper [? really a *Senecio*]. The Carabid *Arsinoë quadriguttata*, Castelnau, was taken on low herbage.

Two crickets and several unnamed Acridians were captured, including one which made a loud snapping noise in leaping, whereas the very spiny-legged *Acridium ruficorne*, Fabr., sat on a bush and made no attempt to escape. From under a log was unearthed an immature female *Blatta*, which Mr. Shelford thinks may possibly be a new species.

A blue wasp was taken, and several others seen; it turns out to be a new species and has been named by Col. C. T. Bingham *Notogonia dixeyi*; while under a log were found a number of the big-headed soldiers and thin workers of *Camponotus maculatus*, Fabr.

The conspicuous Reduviid bug, *Physorhynchus crux*, Thunb., was common under logs of wood, corrugated iron, etc., near the lighthouse; it has a peculiar pungent odour.

The sole fly brought home was apparently the cosmopolitan *Sarcophaga carnaria*, Linn.

Congella, some three miles to the west of Durban, is also a very pleasant locality. The ground rises gradually

from near the level of the harbour for perhaps a mile to the large banana plantations from 200 to 300 feet above sea level, the slopes being covered with wild scrub traversed by a woodland track, while through the lower portions are cut wide grass-covered roadways foreshadowing the development of an eligible building estate.

As usual, *Limnas chrysippus*, Linn., was to be had; we took five males and a female. We took a female of *Amauris echeria*, Stoll, and three females of *A. albimaculata*, Butl., the latter flew slowly and was easily caught. *Acræa* was well represented, the commonest species being the black, yellow-spotted *A. cabira*, Hopff.; of this one specimen was taken on *Lantana* flowers, but as a rule it was seen flying about the tops of trees, in which situation it looked a much larger insect than it is; thirteen specimens were taken, one of these which reached the hotel alive, having survived pinching as *Acrææ* so often do, proved very resistant to chloroform. *A. terpsichore*, Linn. [of which the southern form = *buxtoni*, Butl.], looks on the wing like a small British *Argynnis*; we took five. Of *A. petræa*, Boisd., which when alive is very rosy, both above and below, we took two. Of *A. natalica*, Boisd., we got one among grass; its hind-wings have a rosy flush in life, indeed the beauty of many of these *Acrææ* cannot be appreciated from cabinet specimens; *A. encedon*, Linn., of which we took three, is a feeble insect, with slow flight, but it again succeeded in passing itself off (momentarily) as *chrysippus*. A single male *Planema aganice*, Hew., completed the group.

Byblia goetzius, Herbst, flew over the grass like a "Pearl-bordered"; one settled on a red path, another on dead grass, both with wings erect, both inconspicuous; we took a male and four females, one of the latter was "quite dry." Two *Neptis agatha*, Cram., were taken flying slowly. *Precis elgiva*, Hew., a retiring insect, was found in the track through the wood, of four specimens one was much battered; of *P. clelia*, Cram., several were seen; of *P. natalica*, Feld., two, of the dry form, one worn; of *P. sesamus*, Trim., one settled closely appressed to the ground; also at the edge of the banana garden, on very red soil a *Precis* was seen three times quite clearly, but unfortunately missed; this was either *P. octavia*, Cram. (the wet-season form of *sesamus*), or something uncommonly like it; it nearly matched the red soil in colour, but was

somewhat more orange in tint. Of *Salamis anacardii*, Linn., one of each sex was obtained; of *Atella phalanta*, Dru., a single example; of *Charaxes varanes*, Cram., usually a high flier, a female was luckily netted off a shrub. *Mycalesis safitza*, Hew., was common; four males and nine females were taken.

No specimens of *Belenois severina*, Cram., appear to have been brought back from Congella, but it was certainly common there; of *B. gidica*, Godt., we took three of each sex, one had the hind-wings chipped symmetrically, apparently by a bird; of two specimens taken *in cop.* the male was dry, the female very dry. Of *B. thysa*, Hopff., we took six males, but we have no record of its model *Mylothris agathina* from that locality. Both these butterflies have strong scents, which are distinct. Of *Glutophrissa saba*, Fabr., and *Nychitona alcesta*, Cram., single examples were taken; the latter has a slow, flapping flight. Of *Eronia cleodora*, Hübn., we took two; of *E. leda*, Dbl., a single female; of *Pinacopteryx pigea*, Boisd., nine, four males and five females; of *P. charina*, Boisd., a solitary male. Congella is not the sort of locality that *Teracolus* especially delights in, and the genus was represented by but single male specimens of *T. achine*, Cram., *T. omphale*, Godt., and three males of *T. speciosus*, Wallgr. Of *Terias regularis*, Butl., we took four males and two females.

Of *Papilio demodocus*, Esp., which frequents high and open ground, we took one in the cultivated region above the woods, but of *P. nireus*, Linn., f. *lyæus*, Dbl., we got four males by taking advantage of its habit of not infrequently flying low and even settling on the ground.

Of *Zizera lysimon*, Hübn., we took two; of *Tarucus telicanus*, Lang, five, of which at least four were females, one with the fore-wings injured apparently by a bird; of *Lycæna boetica*, Linn., two; of *Castalius calice*, Hopff., one, a tattered specimen, and of *Virachola antalus*, Hopff., one female, boxed off a plant close to the ground; it was sitting head-downward, but the "false head" had been bitten off, so that it could not deceive again.

Among the Skippers were the familiar dingy *Gegenes zetterstedti*, Wallgr., two; *Baoris fatuellus*, Hopff., one; *Sarangesa motozi*, Wallgr., one; *Acleros mackenii*, Trimen, one male and two females, this and other Skippers were more active on dull days than most butterflies; *Eretis djælælæ*, Wallgr., one, settled with wings outspread;

and *Pterygospidea flesus*, Fabr., seven. Of the last species several were seen to settle on the *upper* sides of leaves, with wings spread out like a Boarmid.

The beautiful *Egybolia vaillantina*, Stoll, was rather common, it is a slow feeble flier, the wings flapping much, so it was easy to catch six specimens. The Lymantriad *Euproctis punctifera*, Walk., of which we took three males and a female, was very common, it is one of those insects which look on the wing far larger than they are, an appearance that may be due to bright colour (in this case orange) or to the mode of flight. Of the small Syntomid *Pseudonaclia puella*, Boisd., and the Chalcosiine *Anomœotes levis*, Feld., we took two each, this last looks surprisingly large on the wing.* Other moths taken were the Geometer *Gracillodes caffra*, Guen., one; the Pyrale *Antigastra morysalis*, Walk., one; *Tinægeria* sp., one, and several other unnamed Micros.

The *Odonata* were represented by two *Orthetrum fasciolatum*, Ramb. ♂, and one *Brachybasis rhomboidalis*, Beauv. The *Orthoptera* by a Blatta, found under a log, *Deropeltis autraniana*, Sauss., immature; also an Acridian, *Tryxalis ståli*, Boliv., which was very hard to see, being shaped and coloured like a piece of dead grass or straw.

Near the reservoir, on a shrubby lavender-flowered composite, were taken together the South African form of *Apis mellifica*, Linn., and the Syrphid *Eristalis tæniops*, Wied., which was noticed to be a fairly close mimic of the bee.

The beetles found at Congella were the Clavicorn *Megalodacne grandis*, Fabr., and the Heteromerous *Anthracias taurus*, Fabr., both found under logs; also *Endema nobilis*, Klug, and the very distinct Carabid, *Thyreopterus flavo-signatus*, Dej., under the bark of a dead stump among numerous ants.

From Durban to Johannesburg.

August 22, 1905.—The first point of the journey over the Highlands of Natal at which we had a few minutes' time to

* Compare my observations on the Indian Chalcosiine, *Aglaope hyalina*, Koll., in Trans. Ent. Soc. Lond. 1905, p. 68.—G. B. L.

leave the luxurious carriages of the Government Railway was INCHANGA, 2,470 feet above sea level. Here on some sandy ground near a stream bordered by rushes and coarse grass or on a bank with a few flowers (? *Senecio* sp.) we took a "dry" specimen of the Satyrid *Pseudonympha cassius*, Godt.; a wasp prettily marked with rich brown, black and white, *Polistes fastidiosus*, Sauss., ☿; a handsome Braconid, *Iphiaulax whitei*, Cameron; and an apple-green *Mantis* larva; also by sweeping the *Senecio*, etc., two *Apis mellifica*, Linn., race *adansonii*, Latr., ☿; an Asilid ? *Dysmachus* sp., and the grasshopper *Catantops melanostictus*, Schaum.

We spent the night at the Falls of the Umgeni, at HOWICK, Lat. 29° 28′ S., 3,400 feet above sea level, and before dark turned over a few basalt stones, taking a number of ants, *Pheidole irritans*, Smith; two *Blattæ* with a very strong, sweet, rather pleasant scent, suggesting pear-drops (or amyl acetate), they were immature, possibly of a new species (R. Shelford); a small beetle, *Euleptus caffer*, Boh., and an Acridian, at present unnamed. It was cold at night here.

August 23, 1905.—At MOOI RIVER Station, Lat. 29° 17 S., alt. 4,600 feet, we took a solitary Acridian only.

At ESTCOURT, Lat. 29° 2′ S., alt. 3,800 feet, on an open grassy place near the Station we were rather more successful. Two males of *Synchloë hellica*, Linn., were secured; they were noticed when at rest to withdraw the fore-wings completely between the hind-wings, and to raise the abdomen. We also took a small Syntomid (as yet unnamed), a Lady-bird, *Epilachna similis*, Thunb.; two ants, *Camponotus cosmicus*, Smith, and a locust *Trilophidia*, sp.; this was discovered by Mr. G. A. K. Marshall, and declared by Señor Bolivar to be a new species, but it has not yet been named by him.

COLENSO, Lat. 28° 46′ S., alt. 3,200 feet. The late afternoon was spent on the low ground south of the Tugela, between the river and the spot where Col. Long's guns were abandoned. The only butterflies seen were *Pyrameis cardui* and *Limnas chrysippus*. Several moths were kicked up, the Boarmid Geometers *Osteodes turbulenta*, Guen., two; *Zamarada pulverosa*, Warr., one; and *Nassunia petavia*, Stoll, a male; also two tiny Noctuæ with yellow hind-wings, *Pseudosterrha sperans*, Feld.; a Crambus and two Micros, none of them yet named. Two immature

Acridians of the colour of dry grass were taken, also a beetle *Scaptobius natalensis*, Boh., one, and the Heteromeron *Opatrum ? arenarium*, Fabr., six. Several specimens of the ant *Pheidole irritans*, Smith, were taken, also some Termites, two workers and two soldiers of the same community. The former when taken were carrying bits of grass and leaves, when brought back to the hotel they were dead and partly mutilated, ? by the soldiers in the same pill-box. The soldiers, on the contrary, reached home alive and pugnacious, for they would grasp the point of the forceps and allow themselves to be lifted off the ground without letting go.

August 24, 1905.—The next forenoon we ascended Hlangwane, the hill commanding the whole position, which unfortunately Buller did *not* occupy on December 15th, 1899. Again we saw no butterflies, and this morning we did not even get a moth! Under cow-dung on the plain two specimens of a dung-beetle were found, *Eratognathus natalensis*, Pér., and under stones, chiefly on the hill, we found an *Omostropus*, which M. Péringuey says is new; an immature bug and sundry ants, to wit, the small *Pheidole irritans*, Smith, of which the workers are very tiny; *P. megacephala*, Fabr., well deserving its name, and the big black *Mesoponera caffraria*, Smith; also a *Blatta*, sp., and an Ant-lion. Near the top of the hill a large family of the Cockroach, *Deropeltis erythrocephala*, Fabr., was found under a stone.

Under stones in and among the Boer trenches a number of large scorpions were found, olive-coloured, with testaceous rings, the large joint of the chelæ and tip of the tail pale testaceous, paler beneath. Other dwellers under stones were very young snakes, a nearly globular toad which squeaked piteously when taken up, and a gecko.

A drive to Hart's Hill in the afternoon made one realize completely what is meant by "carriage exercise," for the road is probably the worst that we ever traversed. It proved more interesting from the point of view of Military History than that of Entomology, nevertheless at the bottom of the Hill we kicked up *Sterrhanthia lineata*, Warr., a brownish Geometer near *Sterrha sacraria*, Linn.; on the slopes, we took under stones *Harpalus capicola*, Dej., ♂; *Pæderus crassus*, Boh.; a "Staph" represented both in the General Collection at South Kensington and in the Sharp Collection, but in both unnamed; the big ant

Acantholepis vestita, Smith; the tiny *Pheidole irritans,* Smith; and *Tetramorium solidum,* Emery.

On the summit of the Hill, in an old Boer trench, looking down over the slopes on which many a brave soldier breathed his last, was *Pyrameis cardui,* Linn., the only butterfly that we saw that day. It may be remarked that it was bitterly cold when we reached Ladysmith a little before midnight.

LADYSMITH, Lat. 28° 38′, 3,300 ft., August 25, 1905.—The next day was devoted to Spion Kop, and naturally enough disputed questions of strategy and tactics diverted our attention from the *Arthropoda.* A specimen of *Precis sesamus,* Trim., was taken close to a Boer's grave near the farm-house below the Aloe Knoll, while a conspicuous Larentid, *Ortholitha pudicata,* Walk., with reddish fore-wings and orange hind-wings, was netted on the top of the Knoll. The beetle *Zophosis caffer,* Deyr., was found just below, running on the path. A small grasshopper was brought from the summit of Spion Kop, and a larger species from the lower slopes on the north side; this last was coloured like dead grass on the exposed portions, but the lower surface of the abdomen and the lower edges of the femora were of a deep bright red. On the road back to Ladysmith, near the half-way house, the conspicuous *Graphipterus cordiger,* Klug, was taken under a stone, as well as the dingy *Zophosis caffer,* Deyr.

August 26, 1905.—On our walk out to Waggon Hill and Cæsar's Camp we found under a stone on the open veldt a Carabid, *Polyhirma notata,* Perond.; when touched it emitted from its mouth a quantity of dark brown fluid having no perceptible odour. The dingy Boarmid *Semiothisa brongusaria,* Walk., was common on rough bushy ground.

The famous work at the western end of Waggon Hill was garrisoned by *Precis sesamus,* Trim., while the variable Geometer *Tephrina catalaunaria,* Guen., was taken close to the Earl of Ava's grave.

Within the trenches of Cæsar's Camp we took the Geometer *Tephrina arenosa,* Butl., as well as two Acridians.

Returning to Ladysmith we found on the northern, reverse, slope of Cæsar's Camp, under large stones near the head of the (then) dry spruit, the curious cockroach, *Homalodemas porcellio,* Gerst. (= *Derocalymna intermedia,* Kirby). It is remarkably flat and sits closely appressed

to the stones; it appeared to be extremely local. Between this point and the bridge over the Klip River just outside the town we found insects much commoner. The scrub is intersected with deep gullies, for the most part dry, but evidently conveying at some time much water to the Klip; in these gullies *Precis cebrene*, Trim., and *P. sesamus*, Trim., were not uncommon, also *Synchloë hellica*, Linn., of which a male and four females were taken. A male of *Colias electra*, Linn., and a female of *Teracolus eris*, Klug, were taken near the river. Single examples of *Yphthima asterope*, Klug, *Zizera lysimon*, Hübn., and *Tarucus sybaris*, Hopff., ♀, were secured, while other Lycænids were seen, as also *Pyrameis cardui*, and *Limnas chrysippus*.

The Quadrifid Noctua *Acanthonyx prætoriæ*, Dist., was taken resting in the dry bed of a spruit; the dingy Boarmid, *Osteodes turbulenta*, Guen., and other Geometers were kicked up, including a beautiful green one (with somewhat the look of *Euchloris vernaria*, Hübn.) which got away in the undergrowth. An ichneumon and a common honey-bee were also taken. A small bug, *Pododus* sp. (not in the National Collection), was seen running on the sand; on being pinned it exhaled a strong odour of acetate of amyl. The beetle *Zophosis caffer*, Deyr., while running swiftly over the sand was occasionally blown over by the wind.

The electric lights about the town and railway-station attracted a fair number of insects, the commonest being the large flying ant, *Dorylus helvolus*, Linn., ♂, a yellowish-brown insect with very flexible abdomen, whose position in the insect world was at the time a puzzle to us. When pinned, the thorax cracked and emitted a puff of white powder. The largest insect at light was the Lamellicorn, *Oryctes boaz*, Fabr., a rotten-wood feeder, of which two were taken. With these were the Noctuids *Audea variegata*, Hmpsn., *Borolia* [*Leucania*] *melianoides*, Möschl., *Homoptera canescens*, Walk.; the Syntomid, *Thyretes caffra*, Wallgr., ♂; three Phycids, *Microthrix inconspicuella*, Rag. (1) and *M. insulsella*, Rag. (2), and several other moths not yet named.

Two moths, *Plusia limbirena*, Guen., and a Micro, were taken in the bedroom of the hotel.

August 27, 1905.—An afternoon was spent on the north-eastern defences, "The King's Post," and "The Devons' Post," which were on low rocky hills with a little low scrub.

At the latter, which runs out towards Lombard's Kop, exposed to the cross-fire of two "Long Toms," the works were more solid and better built than any that we came across, and showed pretty plainly that there must have been skilful wallers among the Men of Devon. Single specimens of *Precis archesia*, Cram., *Acræa neobule*, Dbl. and Hew. (semi-transparent), and *Byblia ilithyia*, Dru., were taken at the King's Post, but the commonest butterfly there was *Pyrameis cardui*, for the most part small and rather worn specimens; flying with it was *Utetheisa* (*Deiopeia*) *pulchella*, Linn. Lizards were numerous, but although some time was given up to watching them, they were not seen to make any attacks on butterflies.

At the Devons' Post *Synchloë hellica*, *Pyrameis cardui*, *Precis cebrene*, and *Zizera lysimon*, were taken. By a stream separating the two hills *Yphthima asterope*, Klug, was rather common, looking not unlike a Blue on the wing; futile attempts were made to see the butterfly settle, but it was restless. At the flowers of *Aloe ? ferox* were *Xylocopa hottentota*, Smith, ♀, the wasps *Belonogaster distinguendus*, Kohl, 3 ☿, and *Eumenes dimidiatipennis*, Sauss., ♀, a large red and black, brown-winged insect, as well as the Phytophagid *Ortalia pallens*, Muls., taken flying near the same flowers.

Anywhere along the ridge that strange locust *Phymateus leprosus*, Serv., might be seen. This is of a grey- or yellowish-green, tinted with yellow, orange and pink. Its hard thorax though strongly tuberculate shines with an enamel-like texture. It is very sluggish, and unlike most locusts does not readily take flight, but when it does so makes a rattling noise. When touched it emits copiously a dark olive-green very fetid fluid, which dries up as a sticky varnish; this accidentally tasted was found to be bitter and unpleasant.

August 28, 1905.—At Ingagane Station, Lat. 27° 56′ S., altitude 3,900 feet, a specimen of the Geodephagous beetle, *Acupalpus natalicus*, Pér., was found under a lump of hard earth.

At Newcastle, Lat. 27° 48′ S., altitude 3,900 feet, a specimen of *Precis sesamus*, Trim., was found in a tiny dark kloof, its love of darkness was also noted on subsequent occasions. Several Acridians, whose determination is postponed, were taken. Also an immature Blatta, *Cosmozosteria* sp., was found under a flat piece of iron,

together with a community of the ant, *Acantholepis vestita*, Smith. The Heteromerous beetle, *Zophosis caffer*, Deyr., was caught running swiftly over sand.

At Inkwelo, under the shadow of Amajuba (Lat. 27° 32′ S., about 4,500 feet above the sea), a fly, *Sarcophaga* sp., was taken, but on this day at these altitudes the conditions were decidedly wintry, and the night of August 28th was cold.

Johannesburg, Transvaal.

Lat. 26° 10′ S. Altitude 5,700 feet. Aug. 30th—Sept. 2nd.

The weather during our short stay was chilly and almost sunless, while the time available only permitted of two short afternoon walks in the outskirts just beyond West Cliff.

But three butterflies were seen, *Pyrameis cardui*, Linn.; *Papilio demodocus*, Esp.; and the Skipper *Baoris ayresii*, Trim., a species that does not appear to be widely spread. Moths were about as poorly represented by the cosmopolitan *Nomophila noctuella*, Schiff., by *Sterrha sacraria*, Linn., of the dingy South African form, and by that obscure Phycid, the almost cosmopolitan *Etiella zinckenella*, Treit.

The most promising mode of collecting appeared to be turning over stones, old tins, etc., on the veldt; this back-aching process yielded ants in great plenty, the commonest species being the big-headed *Camponotus marginatus*, Latr., which turned up in this locality only; close by, the more generally distributed *C. maculatus*, Fabr., was found, while the long black *Plectroctena caffra*, Spinola, the smaller *Philodole megacephala*, Fabr., and two *Cremastogaster sordidula*, Nyl. var., were also met with. There were in addition to the ants plenty of Termites.

The beetles included several Carabids, viz.: *Chlænius sellatus*, Dej., two; another *Chlænius* that may possibly be new; *Harpalus deceptor*, Pér., nine specimens; *H. angustipennis*, Boh., two; *Macrochilus dorsalis*, Klug, one; *Trechus rufipes*, Boh., one; then there were two of a *Trigonopus* that may possibly be new; the very distinctly marked *Graphipterus cordiger*, Klug; an *Opatrum* that is probably *arenarium*, Fabr., six specimens; an unnamed *Psaryphis*; a Lamellicorn of the genus *Aphodius* that is not represented in the National Collection; two weevils, *Hipporhinus corniculatus*, Fabr.; and *Brachycerus severus*,

Fåhr.; also a Lady-bird, *Exochomus nigromaculatus*, Goez., which is occasionally found in Britain.

Under stones were two Pentatomid bugs, *Dalsira modesta*, Fabr., and the lance-head-shaped *Gonopsis angularis*, Dall., also *Lygæus rivularis*, Germ.; there were also several other bugs that are not yet named. Along with the bugs were several *Blattæ* and a black and red scorpion. A number of as yet undetermined Acridians were also taken.

By far the most interesting insect met with at Johannesburg was a Homopteron, *Gyaria walkeri*, Stål., allied to *Flata*, a genus well known from its alleged resemblance when at rest to a spike of flowers. It is of a creamy-white colour with eyes of a beautiful pinkish hue, which is unfortunately soon lost after death by cyanide. The insects are gregarious, and sit in rows of from three to five each near the *base* of the stems of a shrubby herb which attains the height of about two feet. Sitting for the most part with their heads up, they cannot be said to look in the least like flowers, the larvæ indeed look more like a *Coccus*, or even a luxuriant growth of *Penicillium*. When a plant harbouring the *Gyariæ* is approached the insects jump off and then fly away a short distance much like moths. They were only found within a very circumscribed area.

Settled on rocks basking in what little sun was to be had several flies were captured, all males, of a species of *Dichætometopia* allied to *tessellata*, Macq., but probably new to science.

Pretoria, Transvaal.

Lat. 25° 53′. Altitude 4,500 feet. August 31st.

The British Association paid a mere flying visit to the political capital, but this just permitted a carriage-drive to the Wonderboom,* which stands at the foot of the northern slope of a range of hills about $3\frac{1}{2}$ miles to the north of the city. So far as results were concerned the time and trouble, and more particularly the dust, might as well have been saved. Insects were very scarce save at the sweet-scented white flowers of *Dombeya densiflora*, which proved very attractive. There was however an incommensurability between the height of the trees and the length of the net-stick which was tantalizing in the extreme. A few white butterflies were *seen* as well as *Limnas chrysippus*, and a Lycænid. The pedunculated wasp *Belonogaster*

* A singular tree of wide-spreading growth.

griseus, Fabr., was abundant, and four males were with difficulty secured; the South African form of *Apis mellifica*, was also busily at work together with two smaller bees (♀ ♀). These last Col. C. T. Bingham has described as a new species under the name of *Ceratina vittata*, so an otherwise disappointing day was redeemed. A specimen of the Chafer *Oxythyrea marginalis*, Schönh., was taken on the lavender flowers of a *Buddleia* near the river, and close by a single example of *Spindasis mozambica*, Bert. On the veldt below the big tree, the common but pretty locust *Catantops melanostictus*, Schaum, was very active and difficult to secure; in the same place we netted two specimens of *Terias brigitta*, Cram., a species we had not met with in Natal.

RAILWAY JOURNEY FROM JOHANNESBURG TO KIMBERLEY.

September 4th, 1905.

GLEN SIDING. Lat. 28° 55′ S.

On the flowers of a low-growing *Senecio* (not unlike the Oxford *squalidus*, L.) a wasp was taken, *Ammophila ? argentea*, Brullé, ♀, which Col. C. T. Bingham says is not typical, but possibly a local form of the species; with this was a honey-bee, *Apis adansonii*, Latr., ☿. At this place *Pyrameis cardui* and *Colias electra* were noted.

BLOEMFONTEIN. Lat. 29° 7′; alt. 4,500 feet.

In the station-yard here the last named two butterflies were again seen, and a female *Synchloë hellica* was taken.

NORVAL'S PONT, CAPE COLONY. Lat. 30° 38′; 4,000 ft.

The cosmopolitan *Plutella cruciferarum*, Zell., came to our lights.

COLESBERG JUNCTION. Lat. 30° 44′; alt. 4,370 feet.

At this station, which one naturally associates with the exploits of General French, several moths visited the lights of the train. They were the pretty silver-striped Geometer *Conchia nitidula*, Cram.; a Noctua (unnamed); our old friend of many lands *Nomophila noctuella*, Schiff.; and three Phycids, two of them being the dingy *Microthrix insulsella*, Rag.

Kimberley, Griqualand West.

Lat. 28° 43′ S. Altitude 4,010 feet. Sept. 5–7, 1905.

The Diamond City with its white dust (in striking contrast to the red of the Golden City) did not impress one as a good locality, moreover we had but little spare time, and the weather, for the most part cloudy, was unfavourable.

At Kenilworth the weevil *Cleonus mucidus*, Gerst., was beaten from *Senecio*, and two dead *Heteromera*, *Psammodes vialis*, ? Burch., and *P. scabricollis*, Gerst., as well as an earwig were taken under stones. Under one stone a large dark short-legged spider with globular abdomen was found in the midst of copious remains of beetles, etc.

On the veldt in the outskirts of the town, beyond the Old Kimberley Mine, the following were found by turning over stones, old tins, etc. :—The Lamellicorn, *Trox denticulatus*, Oliv.; the Heteromeron, *Psammodes vialis*, ? Burch., two dead specimens; the Weevils, *Brachycerus globosus*, Fabr., one; *Episus bohemani*, Auriv., one; *Sparticerus* sp., four; and *S. rudis*, Fåhr., nine. None of the last three species were represented in the British Museum; for weevils their integuments are but moderately hard, but, on the other hand, in the red sandy soil under the old tins, or among the roots of composite plants, their rough surface as well as their colour make them difficult to see. Eight specimens of the Carabid, *Bæoglossa melanaria*, Boh., were found in holes in the ground under stones or tins; they ran fast when disturbed. It was noted that under the South African sun even large stones, not to speak of the omnipresent rusty tins, afford so little protection that in many cases insects were found lurking in holes in the earth beneath, so that they were doubtless often passed over. Besides the above beetles the stones and tins harboured a number of the Ant *Monomorium subopacum*, Smith, race *australe*, Emery.

Under an old calf's foot and pastern were three specimens of *Necrobia rufipes*, Fabr., a British insect; two of the cosmopolitan *Dermestes vulpinus*, Fabr., and another beetle not yet named. The fly *Agria nuba*, Wied., was captured in the same locality.

At the Dutoitspan Mine we saw *Pyrameis cardui*, and took two *Synchloë hellica*, one of each sex, as well as the Locust *Acrotylus* sp. A Longicorn, *Tetradia lophoptera*,

Guér., was seen on the wing, it settled on the light grey road of the Compound and disappeared, being so exactly the colour of the dust that it was most easily found by feeling with the hand!

At the Wesselton Mine, on a weedy piece of waste ground, two specimens of a Lycænid, so worn as to be scarcely recognizable, were netted; as well as two of a very elegant Bombylius, *Systœchus* sp., which was only to be seen on the wing as the light caught its long white pubescence.

A dull, cheerless morning was spent on the Golf Links, in sight of the Memorial to the Honoured Dead. There seemed to be nothing to do but turn over stones, which, though doubtless an annoyance to the golfers, afforded shelter to a number of *Arthropoda*. The most interesting beetle was *Graphipterus cordiger*, Klug, a quite soft insect of a drab colour bearing a black mark upon its elytra which has been variously compared to a heart, a fiddle and a tennis-racquet; of this we secured eight examples. Of the weevil *Sparticerus rudis*, Fåhr., which was very common, we took seven specimens, again noticing its resemblance to the red soil of the veldt. It may be here mentioned that the general colour of the soil at Kimberley, as at Johannesburg, Pretoria, Durban, and indeed most of the places that we visited, is red; the white dust that is so disagreeable in the town is derived from the mining refuse, and a very similar dust is met with near the gold mines of the Rand. Among the common *S. rudis*, Fåhr., was found another *Sparticerus* which shammed death, this species is not represented in the British Museum collection; we also took two *Episus bohemani*, Auriv. The *Carabidæ* were represented by one *Bæoglossa melanaria*, Boh., three *Harpalus hybridus*, Boh., all females, and five *H. affinis*, Pér. Dead examples of the Heteromera, *Psammodes scabricollis*, Gerst., and *P. vialis*, ? Burch., with other remains showed that it was not the season for that genus, and a large beetle-larva which was unearthed pointed to the same conclusion.

With the beetles were several bugs and an ant, *Aphænogaster barbara*, Linn., var. *capensis*, Mayr., accompanied by a number of "silver fish" (*Thysanura*).

RAILWAY JOURNEY FROM KIMBERLEY TO BULAWAYO.

September 7th and 8th, 1905.

TAUNGS, BRITISH BECHUANALAND. Lat. 27° 33′ S. Alt. 3,590 feet.

The very distinct Catocaline Noctua *Chalciope rivulata*, Hmpsn., and a Tinea, not as yet determined, came to light in the train.

MOCHUDI, BECHUANALAND. Lat. 24° 22′ S. Alt. 3,100 feet.

Two flies which would appear to be the too familiar *Musca domestica*, Linn., were taken near the station, as well as an obscure beetle found under a stone.

It was somewhere near this place that we entered the forest characteristic of this part of Africa, an open or easily penetrable growth, with deciduous trees of moderate size having a tendency to be flat-topped.

ARTESIA. Lat. circa 24° S. Alt. 3,100 feet.

A female of the very African-looking Lycænid, *Zeritis damarensis*, Trim., as well as a specimen of the wide-ranging *Lycæna bœtica*, Linn., also a female, were netted; the hasty turning over of a few stones yielded the pentatomid bug *Diploxys acanthura*, Westw.; four ants, *Camponotus maculatus*, Fabr.; also a dead beetle with a very hard carapace, *Anomalipus* sp., represented in the British Museum collection, but without a name; as well as a weevil, *Sparticerus* sp.

MAHALAPYE. Lat. 23° 3′ S. Alt. 3,300 feet.

Here we entered the tropics, an event that was signalised by the capture of a male *Catopsilia florella*, Fabr., and the determination of its sweet scent.

PALAPYE ROAD STATION. Lat. 22° 44′ S. Alt. 3,010 feet.

The beetle *Xenitenus dilucidus*, Pér., was taken in the train.

SERUI. Lat. 22° 27′ S.

The electric lights of the train attracted a number of insects while stopping at this station, among those that were secured were the very small drab Noctua, *Eutlemma*

sp. (near *fœdosa*, Guen.), a Quadrifid Noctua, *Homoptera* sp., an Acontiid Noctua, *Arcyophora rhoda*, Hmpsn., a flying ant, *Mesoponera caffraria*, Smith, a female; and several moths not yet determined, comprising some other Noctuæ, a Geometer, a Phycid and a Crambus.

Bulawayo, South Rhodesia. Lat. 20° 9′ S. Alt. 4,470 feet. September 9–11, 1905.

The most promising spot near the Matabili Capital was, we were told, the Waterworks situated a few miles to the westward, at an altitude of perhaps 4,600 feet.

Two shrubs in full flower proved very attractive to insects: one with white sweet-scented flowers, *Dombeya ? rotundifolia*, Harv. [Nat. Ord. *Sterculiaceæ*], was frequented by *Acræa doubledayi*, Gúer., though these butterflies seemed shy of actually settling upon the flowers. Altogether we took seven specimens, three about the *Dombeya*. On these flowers we also took the slender Scoliad *Myzine capitata*, Smith, ♂, and the long-bodied wasp *Belonogaster griseus*, Fabr., ☿; there were also two beetles of the genus *Mylabris* (or perhaps *Ceroctis*), a Cantharid of very similar colouring to the Longicorn *Hylomela sexpunctata*, Fabr., a species that we met with at Ladysmith and East London, but not nearer; two of the Cetoniid, *Rhabdotis* [*Pachnoda*] *sobrina*, G. and P., were also taken on the *Dombeya*; it is an active insect easily alarmed and taking flight. This dark olive-brown beetle is less conspicuous on the white flower than might be expected owing to the small white spots with which it is relieved breaking up the mass of its ground-colour. Another entomologist had discovered the attractive powers of the *Dombeya* before we did—the yellowish-grey, yellow-marked *Chamæleon dilepis*, Leach, ♀; it was surprising that so large an animal could be so inconspicuous.

The other attractive shrub was a species of *Combretum* [Nat. Ord. *Combretaceæ*] with spikes of yellowish-green flowers having the superficial appearance of catkins. This was especially attractive; it was frequented by *Acræa doubledayi*, Guér.; but the Lycænid *Axiocerces harpax*, Fabr., settled on it in large numbers, and seven specimens, five of them males, were secured; they closely resembled when so settled the curiously formed old dry seed-vessels of the *Combretum* of which many remained on the bush.

Other Lycænids at the same flowers were *Crudaria leroma*, Wallgr., of which only two were obtained, together with single specimens of *Tarucus telicanus*, Lang, ♂, and *Aloeides? taikosama*, Wallgr., ♂. With these butterflies were a number of other insects, conspicuous among them the bright coral-red Braconid, *Iphiaulax whitei*, Cameron, its smoky-black wings bearing a scarlet (or yellowish) triangle on the costa, and the large blue-winged pedunculated wasp *Eumenes dyschera*, Sauss., var. ♂. Less striking hymenoptera were *Icaria cincta*, Lepel., ☿, and the new species *Myzine rufo-nigra*, Bingh., ♂. The Sphex *Chalicodoma cæloccra*, Smith, ♀, was taken at a flowering shrub, whether *Combretum* or some other is uncertain, but be that as it may, the *Combretum* certainly produced an unnamed bug and sundry flies: *Rhynchomyia* sp., *Exoprosopa* sp., and *E. ? lar*, Fabr.

Apart from those found on or about flowers, insects were scarce, and it took a good deal of work to secure the following butterflies:—*Teracolus topha*, Wallgr., a female; *T. antigone*, Boisd., a female which flew slowly near the ground without settling; *T. annæ*, Wallgr., a female; *T. achine*, Cram., two males, and *Terias brigitta*, Cram., a male and two females, the former less "dry" than the latter. Certain dark, yellow-striped orthopterous larvæ were seen on the stems of *Combretum* and other shrubs; they were very gregarious and were observed to advance and halt together as if drilled.

On a stretch of somewhat lower flat country covered with coarse dead grass we saw many individual specimens of the Red Locust, *Schistocerca peregrina*, Oliv., but no swarms; we spent much time in endeavouring to catch these, for they are extremely wary and took to flight when approached within four or five yards. The general colour of the living insect is dark mahogany-red, with some greenish-brown shading, but the wings shine brightly in the sunlight, so that the insects a good deal resemble small flying-fish.

On September 10th we had a delightful excursion to THE MATOPOS, a wild group of granitic hills about forty miles to the S.S.W. of Bulawayo. The veldt may be from 4,500 to 5,000 feet above sea level, the kopjes rising from 100 to 800 feet higher. In the wider valleys are stretches of coarse grass, but for the most part the country is covered by somewhat open scrub and forest, not especially tropical

in aspect. Some of the hills are wooded, others mere bosses of almost smooth granite. Such a country was most attractive, but the length of the drive to and from the terminus left little time for collecting.

The commonest butterfly was *Acræa doubledayi*, Guér., which was taken flying among long grass as well as at the flowers of *Combretum* and *Dombeya*, altogether eight specimens were taken ; a single example of *A. calderena*, Hew., was taken among long grass, together with *Yphthima asterope*, Klug, var. *norma*, Westwd., and the Blue *Everes cissus*, Godt.

The catkin-like racemes of the shrub *Sclerocarya caffra*, Sond. [Nat. Ord. *Anacardiaceæ*], were also very attractive, yielding the Lycænids *Hypolycæna cæculus*, Hopff., a female, and the very beautiful and distinct *Stugeta bowkeri*, Trim., a male, also the now familiar *Apis adansonii*, Latr., ☿; but far more startling than any of these was the beautiful long-beaked Sun-bird with blue throat surmounting a breast of crimson shot with violet.

On the branches of the *Sclerocarya* were a number of *Polyrachis schistacea*, Gerst., a dull black ant with nearly globular abdomen.

A small tree with sweet-scented, viscid, yellow-green flowers, a species of *Gardenia** [Nat. Ord. *Rubiaceæ*], was extremely attractive to insects, and it was interesting to watch the Sphinx *Cephanodes hylas*, Linn., hovering amidst the numerous Carpenter-bees, the commonest of which, *Xylocopa caffra*, Linn., ♀, var. *mossambica*, Grib. (with two white rings on the abdomen), it appeared to mimic; of the other species *X. olivacea*, Fabr., and *X. divisa*, Klug, var., single examples only were secured, females; the former species is very handsome, its thorax being of a beautiful "old gold" colour. A Bombyliid fly, *Systæchus* sp., as well as a male of *Catopsilia florella*, Fabr. (by no means the only one seen), were taken on the same tree.

The *Combretum* attracted besides *Acræa doubledayi*, the Lycænid *Axiocerces harpax*, Fabr., a male, and the fine wasp *Belonogaster griseus*, Fab., ☿, which has a conspicuous yellow spot on the side of the abdomen, also a number of the brilliantly coloured Braconid *Iphiaulax whitei*, Cameron. On the same plant was found a Lady-bird,

* Or possibly *Tricalysia jasminiflora*, Hook., of the same natural order.

Chilomenes sp., which is in the National Collection, but without a name.

On *Dombeya* flowers, besides ants, three specimens of the Cetoniid *Rhabdotis sobrina*, G. and P., were taken.

Certain Aculeates were taken at flowers of one sort or another which it is not now possible to distinguish:—*Belonogaster guerini*, Sauss., ☿, var. *dubius*, Kohl, *Elis* (*Dielis*) *fasciatella*, Hübn., ♂; also the long-waisted, black, red and yellow wasp, *Eumenes lucasia*, Sauss., ♀. This last is the third specimen known to Col. C. T. Bingham, the type being at Paris and the co-type in the British Museum from Bab-el-Mandeb (2,500 miles away); lastly a small slender, black, white-ringed solitary wasp, *Labus ravus*, Bingh., ♀, a new species said by Col. Bingham to come very near the Javan species that is the type of the genus. It would appear to be the first notice of this genus in Africa.

Other things that were picked up on that memorable day were a worn specimen of the pale fawn-coloured *Mycalesis simonsii*, Butl., one of two or three that were seen at one partially shady spot; a large "dry" *Terias brigitta*, Cram., ♀; a *Tryxalis* sp.; a fly, *Anthrax* sp.; and a beetle, *Zophosis angusticollis*, Deyr., found running rapidly over the ground at the "World's View," close to the grave of C. J. Rhodes.

The account of the expedition would not be complete without mention of the swarms of the Red Locust, *Schistocerca peregrina*, Oliv., which during the drive back to the train rose in glittering clouds on every side. It was, however, not without repeated efforts that a few specimens were netted out of the many thousands seen.

In the town of BULUWAYO, *Zophosis caffer*, Deyr., was taken running over the ground, while by turning over stones many things were obtained, including the curious hairy beetle, a Heteromeron, *Usagaria australis*, Pér., four specimens; *Psaryphis* sp., which is not represented in the British Museum; the Geodephagid, *Omostropus consanguineus*, Pér., three; the "Staph," *Myrmedonia procax*, Pér.; a weevil; and the small dingy bug, *Pododus depressus*, Walk.

About the filter-beds near the Railway Station the Lycænids *Zizera lysimon*, Hübn., one, and *Aloeides taikosama*, Wallgr., two males, were taken.

The two beetles, *Meligethes* sp. and *Pseudocolaspis* sp.

(the last mentioned in the National Collection but unnamed), and the small dingy bug *Agonoscelis puberula*, Stål., were taken either at or near Buluwayo, or at the Matopos; the beetle *Pogonobasis* sp. (unnamed in the British Museum) was taken somewhere in South Rhodesia prior to our arrival at the Falls, but the locality cannot be now designated, for the notes concerning these insects are unfortunately defective.

THE RAILWAY JOURNEY FROM BULUWAYO TO THE VICTORIA FALLS.

September 11th, 1905.

Red Bank Station (19 miles from Buluwayo).

We took alongside the train *Teracolus achine*, Cram., a male; *T. antigone*, Boisd., a male; and two fine specimens of *Papilio angolanus*, Goeze [= ? *corinneus*, Bert.], which had probably been disturbed from the drippings of the water-tank.

Saw-Mills Station, near Umguzi (57 miles from Buluwayo).

A male of *Belenois mesentina*, Cram., was netted, also a Noctua flying in the sun. The Red Locust, *Schistocerca peregrina*, Oliv., was abundant. By great exertions we succeeded in catching two.

Gwaai (89 miles from Buluwayo). Lat. 19° 7′ S. Altitude 3,240 feet.

Towards evening the train stopped in a stretch of flat, bare country beside a reedy pond to take in water. A fine specimen of *Charaxes saturnus*, Butl. (the only one we saw in our travels), was taken flying about a low tree. We also took the brilliant cardinal-red dragonfly, *Crocothemis erythræa*, Brullé.

Sweeping the rank vegetation by the pond yielded a multitude of small insects, amongst them a number of the singular fly *Diopsis affinis*, Adams, which carries its eyes and antennae upon long rigid stalks or horns projecting on either side of the head. The appearance of these little black and red flies forcibly suggests a "Watkin Range Finder" in miniature, the eyes being so far separated as to afford an appreciable base-line; if the insect were

resting on the under-side of a stalk it would be able to see its enemies or prey above it without exposing itself. With the *Diopsis* were *Musca ? domestica*, Linn., *Sepedon* sp. and other small flies; two small Scoliads, *Myzine* sp., in too bad condition to name; and other insects, including the Phytophaga, *Haltica pyritosa*, Erich., *Hispa spinulosa*, Boh. [not *H. spinulosa*, Schönh.], *Chætocnema* sp., and a small moth, *Tinægeria* sp.

An unnamed Geometer, the cosmopolitan Tineid *Plutella cruciferarum*, Zell., and the Blatta *Cirphis* [*Paraplecta*] *pallipes*, Stål., all came to light in the train on the night of Sept. 11th between Gwaii and Wankie.

The Victoria Falls of the Zambesi.

Lat. 18° 0′ S. Altitude 3,000 feet. September 12–19.

This was our furthest point and the locality from which we expected most.

Apart altogether from the magnificence of the Falls themselves and the geological puzzles that they afford, the locality presents certain peculiarities to the botanist and entomologist.

Picture a rolling sandy plateau a little over 3,000 feet above sea level. Low distant hills bound the view, though the characteristic South African kopje is for once absent. Above the Falls the banks of the Zambesi are low and almost flat, the country on either side of the river resembling much of that passed through in the railway journey from Buluwayo. The forests of South Rhodesia are chiefly composed of deciduous trees of moderate size, for the most part tending to be flat-topped and so harmonising with the horizontal strata and giving the landscape a character of its own. The undergrowth of scrub is, as a rule, scanty and easily traversed, while the coarse grass and other herbage was so sparse as to leave much burning sand quite bare; though it must be borne in mind that our visit was towards the end of a very dry season. Doubtless during the rains much of this sand would be covered with vegetation and gay with flowers, but as it was we found loose dry sand extending to within a very few feet of the *Papyrus* growing at the water's edge. The banks above the Falls are fringed with a narrow belt of shady wood in which (especially on the right bank) the small date-palm, *Phœnix reclinata*, is the prevailing tree,

and a shrubby *Ipomæa* was at the time of our visit the most striking flower. Here and there towered the monstrous Baobab tree, *Adansonia digitata*, with stem like an inverted carrot. The first leaves on the commoner forest trees spread an emerald tint suggestive of spring and affording a refreshing contrast to the parched herbage and scorching sand.

Opposite to the Falls is the "Rain Forest," poetically called by the Barotse "The place where the rain is born." This stretches along the cleft for three-quarters of a mile, not counting the similar growths on the "Knife-Edge." Between the Rain Forest proper and the edge of the chasm, where the spray is most drenching, is a strip of coarse boggy grass and herbage looking for all the world like a bit of Exmoor into which the bright blue flowers of *Lobelia erinus* have escaped from some parterre. The forest proper, from 50 to perhaps 300 yards wide, is of varied growth, in which large specimens of *Ficus* with their characteristic stems are a prominent feature; but towards the Falls it is bounded by a dense hedge of very bright green trees, *Eugenia cordata*, an evergreen of the myrtle tribe. The amount of spray, or "Rain," naturally varies with the height of the water and the force and direction of the wind. A sound that one soon learns to associate with the ceaseless roar of the cataract and the pattering of the spray-drops on the forest leaves is the musical cry of the "emerald-spotted dove" (*Chalcopelia afra*).*

We saw the Falls at a period of low water, but if this detracts from their grandeur, and above all from their characteristic mystery (by the shrinking of the spray columns), it enables one to see them better and so better comprehend their weird topography. But though the most absorbed collector cannot fail to be impressed by such unwonted surroundings, this is not the place to dwell upon the majesty of the Falls themselves, or the airy beauty of the brilliant rainbows that attend them by day or their more ghostly representatives in the moonlight.

Two pre-eminent impressions remain graven upon the memory—a vast river over a mile in width, dotted with

* For an excellent account of the botany of Southern Rhodesia, with a good description of the Matopo Hills and the country about the Falls, see a paper by Miss L. S. Gibbs, F.L.S., Journal Linnean Soc. 1906, pp. 425–494.

wooded islets, glides noiselessly through the burning sand, coming one knows not whence; and again the same mighty river, with scarce a warning rapid or even swirl upon its peaceful waters, suddenly draws a veil of spray over its face as with a mighty roar it flings itself down 350 feet into a chasm athwart its channel, and emerging thence, one can scarce see how, pursues its long mysterious course between grim basaltic crags through the incredible zigzags of the Batoka.

The hotel is situated close to the railway-station, in the open forest, about a mile from the Falls, and perhaps 100 feet above them, though geographically speaking below. The first insect to attract notice was a large *Acræa* flying about the tops of the trees, occasionally as many as a dozen together. After the exercise of some patience a fair series of specimens and a stiff neck were secured. These butterflies proved to be very beautiful, with pinkish fore-wings and white hind-wings; they were new to Mr. Marshall, but previously known to Mr. Trimen by two specimens only and then considered by him to be a variety of *A. anemosa*, Hew., to which Aurivillius gave the name of *alboradiata*. A long series amply proves this form to be a new species, which should consequently bear the name given to the supposed variety by Aurivillius. If, tired of gazing up at these beauties, the eyes were turned with relief to the ground, ants might be seen running swiftly over the sand with their abdomina borne high in the air. They were *Camponotus fulvopilosus*, De Geer, dull grey-black with pale brown hairy abdomen, very cryptic in their sandy home. The species was common about the hotel and on the way to the Falls. Also running swiftly over the sand a small beetle was taken, a *Zophosis* not in the National Collection. A flowering tree close to the hotel produced the widely spread *Apis mellifica*, Linn., race *adansonii*, Latr., as well as two other bees not yet determined.

The irrigated kitchen-garden of the proprietor attracted numerous insects, the most striking being *Acræa atolmis*, Westw., of which about a dozen, all males, were secured; it is a beautiful insect looking blood-red when alive; with them were taken three *A. atergatis*, Westw.; three male *A. anemosa*, Hew., one of them a dwarf, and two *A. alboradiata*, Auriv., ♂ and ♀. With the Acræas were two females of *Terias brigitta*, Cram., of the dry form, also one

Aphnæus erikssoni, Trim. In the same garden were taken the steely-blue-winged wasp, *Discolia ebenina*, Sauss., four males and a female; also another somewhat fly-like wasp, the handsome black and yellow *Bembex capicola*, Handl., a male—only the second specimen known to Col. C. T. Bingham, the type being at Vienna.

The electric lights of the hotel attracted a considerable number of insects, but they were for the most part small and insignificant in appearance :—

Noctuina.

Xanthoptera opella, Swinh. (3), a common Indian species.
Homoptera scandatula, Feld. (1), a Catocalid.
Homoptera ? n. sp. (1).
Arcyophora ? n. sp. (1). An Acontiad not in the British Museum.
Entelia polychorda, Hmpsn. (1), a variable Quadrifid.
Metachrostis (*Ozarba*) *snelleni*, Wallgr., a very small Quadrifid.

Geometrina.

Comibæna leucospilata, Walk. (1). A pretty emerald.

Pyralina.

Argyractis, sp. (2).
Stemmatophora chloralis, Hmpsn., n. sp. (5). A very distinct and pretty little insect, whitish-green with black central band. [Its description will shortly be published.]
Parthenodes scotalis, Hmpsn., n. sp. (5). A somewhat dingy Hydrocampid. See Ann. and Mag. Nat. Hist., 1906, p. 470.
Platytes, n. sp. (5). A beautiful Crambid which Sir George F. Hampson has kindly promised to describe.
Microthrix insulsella, Rag. (2). A dingy Phycid.
Etiella zinckenella, Treit. (1). An almost cosmopolitan Phycid.
Several other small moths not yet determined.

Neuroptera.

Halter ? *glaumrigi*, Koll. Three specimens of this very singular insect came to the lamps. Its very long, slender and spirally twisted hind-wings make it more like a flying machine than an insect.

? *Œstropis*, sp., and ? *Blymorphanismus* sp., two green Trichoptera, together with other caddis-flies more like European forms.

ORTHOPTERA.

A cricket.

HEMIPTERA.

Acanthaspis nugax, Stål., a Reduviid bug with a peculiar fetor.

COLEOPTERA.

Apate monacha, Fabr. (2 ♀).
Himatismus, sp. (3). Not in the British Museum.
Trochalus, sp. (1). In the National Collection, unnamed.
Xylopertha, sp. (1).

Two Longicorns, *Plocederus melancholicus*, Gahan, and *Tetradia lophoptera*, Guen. (= *fasciatocollis*, Thomps.), also came to light; the latter was captured by one of us on his bed, clinging closely to the sheet, and making a curious creaking noise when disturbed.*

Lastly a male *Acræa alboradiata* was taken fluttering on the floor below an electric light at 9.0 p.m.!

While one of us was busy with the electric lights a waiter excitedly called out that there was a "Tarantula" under the Stoep. He was most anxious that it should be secured, but declared that its bite was deadly. It proved very fleet of foot and doubled like a hare; other waiters joined in the chase, which turned out most exciting, especially when it ran over the neck of the ardent entomologist. When the fierce creature yielded at last to the soothing influence of cyanide it was seen to be of a pale reddish-brown, with pale grey abdomen, but armed with most formidable-looking red-brown mandibles, tipped with black. Black eyes added to its ferocious aspect. Ultimately a second specimen was bottled—together with one of another species.

Above the Falls the RIGHT BANK of the river (here the south-western) was the most readily accessible collecting ground, and perhaps for that reason received an undue

* "The voice no doubt proceeds from the mesonotum."—*G. J. Arrow, in litt.*

amount of attention. There our familiar friend *Limnas chrysippus*, a female somewhat small and dark, was busy with the flowers of *Combretum*. The genus *Acræa* was well represented: *A. alboradiata*, Auriv., though not so common as close to the hotel, was frequently seen, especially near the cascade at the western extremity of the Falls, locally known as the Leaping Waters; with this were several *A. anemosa*, Hew., all males, one very small; we also took three *A. encedon*, Linn.; a single specimen of *A. caldarena*, Hew., a male; *A. rahira*, Boisd.; an *A. atergatis*, Westw., stunted, and close to the Falls a female *A. atolmis*, Westw. In a way the most striking butterfly was *Hamanumida dædalus*, Fabr., for it was the first time that either of us had seen it alive. It was very common, flying close to the ground, and settling on the grey sand or dust with wings spread out flat, in which position it was curiously inconspicuous. *Precis clelia*, Cram., and *P. cebrene*, Trim., were both fairly common, but of *P. natalica*, Feld., and *P. archesia*, Cram., we took but one apiece, the former of the "dry" the latter of the moderately dark, or intermediate form. *P. sesamus*, Trim., was seen though not taken. *Neptis agatha*, Cram., graceful as always, was not uncommon; *Atella phalanta*, Dru., was there also, with its fearless sailing flight, returning again and again to the same spot. Two male *Byblia goetzius*, Herbst, were taken playing together, but *Charaxes varanes*, Cram., was more often seen than netted. The Satyrids were represented by the restless little *Yphthimas*; of these *Y. asterope*, Klug, was common enough in the half-shade, and with them were taken a couple of the var. *norma*, Westw., also two *Y. itonia*, Hew.

The "common white" of the Zambesi appeared to be *Belenois gidica*, Godt., and very dry they were; the dry form of *B. severina*, Cram., was also quite common. Of the *Teracoli* we took five species, by far the commonest being *T. omphale*, Godt., the males predominating; of *T. achine*, Cram., we took four males, of *T. antigone*, Boisd., one. Near the Leaping Waters we got a single female specimen of *T. phlegyas*, Boisd., and two *T. eris*, Klug, both males. Many of the genus fly quickly, but the flight of *T. eris* is specially rapid and erratic, so that in all probability more were seen than taken. *Terias brigitta*, Cram., both sexes, was fairly common, it was especially attracted by a small low-growing, lavender-flowered labiate, four or

five flying together over a patch of it. This butterfly has a jerky flight, so that it proved to be not so very easy to catch as one at first imagined. Of *T. senegalensis*, Boisd., two males were taken. The *Terias* were by no means so markedly "dry" as the *Teracoli*. A single *Papilio corinneus*, Bert. [? *angolanus*, Goeze], was secured.

The *Lycænidæ* were not very prevalent, and no species was abundant. Of the handsome *Stugeta bowkeri*, Trim., and of *Axiocerces amanga*, Westw., we took single examples, but *A. harpax*, Fabr., was commoner, especially among reeds and sedges at the water's edge. Of *Hypolycæna cocculus*, Hopff., *Zizera lysimon*, Hübn., and *Liptena* [= *Durbania*] *pallida*, Trim., we took but one each, the latter at flowers of *Ipomæa*.

The Skippers were represented by solitary male individuals of *Gegenes occulta*, Trim., and *Parnara mathias*, Fabr. (= *mahopaani*, Trim., = *inconspicua*, Boisd.).

In addition to the butterflies already named the following may be mentioned as being taken while drinking at the mud of small inlets and backwaters of the right bank of the river :—

Both sexes of *Acræa alboradiata*, Auriv., and *A. atolmis*, Westw., of which latter the bright coppery-red looks on the wing almost blood-red. *Belenois gidica*, Godt., and *Belenois mesentina*, Cram., both males. Of *Terias brigitta*, Cram., contrary to the usual rule with Pierines at water, a female was taken, but this species, though certainly attracted by water, is of a restless habit like *Yphthima*, and seldom settles. Of *Papilio leonidas*, Fabr., three specimens were taken at mud and others seen; lastly a specimen of *Axiocerces amanga*, Westw.

So much for the butterflies found on the right bank. The moths were far less numerous, and the only things brought home were a Geometer, *Gracillodes caffra*, Guen.; a *Crambus* sp. and another a small, and as yet unnamed Pyrale, *Argyractis* sp.

As might have been expected Dragonflies were fairly numerous, especially a species with a full "cardinal-red" body, *Crocothemis erythræa*, Brullé, which has a very wide range in Africa. Some of these were taken at mud puddles in the back-waters, others about the rocks which extend far into the river above the Falls, rocks on which one often saw the Snake-bird, *Plotus levaillanti*, sitting absolutely still and giving an appropriate finish to the

peaceful landscape. Another large and handsome species, *Pseudomacromia torrida*, Kirby, with a pair of sapphire-like spots behind the eyes, was common, as was also the smaller *Pseudagrion deckeni*, Gerst. Besides these were other Dragonflies not yet named.

A *Myrmeleon* sp. was noted as being the colour of dried grass. Some "white ants" were taken, but, so far as our observations went, Termites are not as common at the Falls as in other parts of South Africa that we visited.

Very little attention was paid to *Diptera*, partly perhaps because, fortunately, they did not pay the usual amount of attention to us; only two were brought home, *Sarcophaga* sp. and *Hæmatopota* sp., the latter taken on the "topi" of the captor.

Of the Aculeates the most striking were the Carpenter-bees, of which the commonest was *Xylocopa divisa*, Klug, found at *Combretum*, or other flowers, though one, a male, was noted as hovering persistently about a tree overhanging the river. The male of this bee is of a beautiful "old-gold" colour; of this sex only two were taken, but females, of the variety with the band on the back of the thorax white in place of "old-gold," were commoner, and four or five specimens were secured. Of *X. caffra*, Linn., we took two specimens, both females of the variety *mossambica*, Grib., with a white ring in place of the usual two yellow rings. Of *X. olivacea*, Fabr., we got but a single female. We met with three species of the very slender-waisted wasps of the genus *Ammophila*, viz.:—*A. ludovica*, Smith, a female, and *A. beniniensis*, Pal. de Beau., a male, both at wet mud, while a female of *A. ferrugineipes*, Lepel., was taken at flowers. Of the large and handsome black and yellow *Sceliphron spirifex*, Linn., we only secured a single female, also at flowers. Of the long-waisted grey wasp *Belonogaster guerini*, Sauss., var. *dubius*, Kohl, a single worker was taken at mud. We also took single examples of *Salius* [= *Hemipepsis*] *vindex*, Smith, a male; the Scoliad *Myzine capitata*, Smith, a male, and the small red wasp *Odynerus carinulatus*, Sauss., a female, the last-named at wet mud. The integuments of two males of *Rhynchium rupeus*, Sauss., proved of a truly rocky hardness. Running over damp mud three specimens of a notable ant were taken, *Paltothyreus tarsatus*, Fabr., notable for its powerful bite, but still more for its evil odour, which is *very* strong and pungent, suggesting a mixture of formic acid and

bisulphide of carbon.* Running along the branches of the tree-*Ipomæa*, near the Leaping Waters, were a number of another ant, *Polyrachis schistacea*, Gerst., which we had seen at the Matopos on *Sclerocarya caffra.*

The *Coleoptera* met with were not very numerous, but comprised *Pogonobasis* sp. (in the National Collection, but without a name), which was taken on the ground by Miss L. S. Gibbs; two specimens of *Scymnus* sp.; three weevils, *Bagous cænosus*, Gyll., which Mr. G. A. K. Marshall had previously seen from Uitenhage, Cape Colony, only; *Rhabdinocerus brachystegiæ*, Mrshl. (*in litt.*) and *Xenorrhinus incultus*, Fst., the first specimen of the latter that Mr. Marshall had seen; also a Eumolpid, *Pseudocolaspis chrysitis*, Gerst.; and two *Heteromera* of the genus *Opatrum*, under dead wood. Two specimens of *Adesmia intricata*, Klug, a Heteromeron only represented in the National Collection by specimens from Mozambique, were found crawling on the ground near the Leaping Waters.

The "Red Locust," *Schistocerca peregrina*, Oliv., was by far the most common and most conspicuous of the *Orthoptera*; as usual it was chiefly found among coarse grass, but could not be said to be gregarious.

In shallows in the river just above the Falls, a small banded water-snail, *Cleopatra morrelli*, Preston (described as n. sp. in April 1905), was to be found, together with a spotted species with sinuated lip, *Melania victoriæ*, Dohrn.

The LEFT BANK of the river differs somewhat from the right. The ground does not lie quite so low in reference to the water, there is more wood and scrub but less grass and fewer palms. A female *Limnas chrysippus*, Linn., was seen at water; of the *Acrææ* the commonest was *A. encedon*, Linn., males predominating, while single female specimens of *A. atolmis*, Westw., and *A. anemosa*, Hew., turned up. *Precis clelia*, Cram., was fairly common, and *P. sesamus*, Trim., was seen, as is its wont, fluttering about and settling under the shade of a dark bank.

The Whites were represented among our captures by two male *Belenois gidica*, Godt. *Teracoli* were far less common than on the right bank, probably because there was less of the open grassy country in which they delight; single specimens only of *T. omphale*, Godt., a male, and *T. eris*, Klug, a female, the latter at *Combretum* flowers,

* For Dr. S. Schönland's observations on the odour of this insect in Bechuanaland, see Proc. Ent. Soc. Lond. 1904, p. xl.

were secured. *Terias* was represented by a female *senegalensis,* Boisd., of the usual dry form, but also by a male *brigitta,* Cram., of distinctly *wet* character—a notable exception among so many very markedly dry butterflies.* A male and two females of *Catopsilia florella,* Fabr., were secured while feeding on the large-flowered species of *Combretum* that grows in the Zambesi scrub; this butterfly was almost certainly seen more than once on the right bank, but eluded capture, for *Catopsilia* is very swift of flight and hard to net save when busy honey-gathering. *Papilio demodocus,* Esp., was taken on the "Knife Edge" near the eastern extremity of the Falls.

Axiocerces amanga, Westw., at *Combretum* flowers, *Zizera lysimon,* Fabr., and *Liptena* [*Durbania*] *pallida,* Trim., were the only Lycænids brought home, the last taken near the top of the Palm Kloof. Between the last-named place and the railway bridge large Libellulid dragonflies were especially common, and comparatively easy to catch as they hovered over the path head to wind, like hawks. The commonest would appear to be *Pseudomacromia torrida,* Kirby; but there was also a species of *Macromia* as well as the slender *Pseudagrion ? deckeni,* Gerst.

Speaking of the railway bridge, perhaps one may be allowed to congratulate the engineer who designed it (Mr. G. A. Hobson, of the firm of Sir Douglas Fox and Partners) on a structure which seems as well fitted to its position alike in form and colour as such a thing can be; one shudders to think what *might* have been placed there by less sympathetic hands.

The only *Hymenoptera* taken on the left bank were two small bees, one at *Ipomæa,* the other *Podalirius rapidus,* Smith, ♀, hovering at *Combretum* flowers, also the coral-red Braconid *Iphiaulax whitei,* Cameron, and a long-waisted wasp, *Belonogaster guerini,* Sauss., var. *dubius,* Kohl, ☿.

Beetles were few and far between: a *Mylabris* sp. (or ? *Ceroctis* sp.), found (here, as well as on the other bank) in the flowers of *Ipomæa,* appears to mimic the Longicorn *Hylomela sexpunctata,* Fabr., a beetle that we met with only at East London. In the same flowers was another beetle, a long narrow purple fellow, not yet named.

A fly that attracted the attention of one of us by

* See Dixey, Proc. Ent. Soc. Lond. 1905, pp. lxi–lxii, and *ibid.* pp. lxvi–lxvii. Compare Longstaff on *T. hecabe,* L., Trans. Ent. Soc. Lond. 1905, p. 144.

biting his hand, *Hæmatopota* sp., was the only Dipteron taken.

If the left bank yielded us but a small bag it was some considerable consolation, at all events to the fortunate observer, to have the opportunity of contemplating from a distance of not more than 100 yards a family of Hippopotami disporting themselves in the water.

By the kindness of the Chartered Company's Forester, Mr. C. E. F. Allen, one of us was enabled to land on two of the wooded islands some miles above the Falls. Entomologically the results were disappointing, but here again Hippopotami came to the rescue, for the thicket on one of the islands was traversed in all directions by their paths, while in an open space lay the fairly recent bones of one of the uncouth monsters. The ubiquitous *Limnas chrysippus* was represented by a male fly, but no *Acræa* was taken, and the only Nymphalines were *Precis natalica*, Feld., with ocellated under-side, and a *Neptis* which eluded capture.

The common white of these islands was *Belenois severina*, Cram., of which five "dry" males were taken; but *B. gidica*, Godt., was nearly as common, and two of each sex were brought home. All the *gidica* from the Zambesi were of extreme dry type, drier than its congener. No *Terias* were taken and but three *Teracoli*, all males, two of *T. antigone*, Boisd., one of *evenina*, Wallgrn. Of *Eronia leda*, Dbl., a female of dry type was taken. The only Satyrids were four *Yphthima asterope*, Klug, var. *norma*, Westw. The Lycænids were even scarcer, as a solitary *Zizera lysimon*, Hübn., was the only Blue.

A Geometer, an "Emerald" with red chequered fringes, *Comibæna leucospilata*, Walk., was the only moth taken, while as unfortunately "other orders" would appear to have been even more than ordinarily neglected, the captures were limited to a single individual of the evil-smelling ant, *Paltothyreus tarsatus*, Fabr., and a pretty black and white two-winged fly, *Tabanus* sp.

Mr. Allen was good enough to give us four insects taken in a druggist's shop at Livingstone, five miles above the Falls: they were two flies, one of them a large, fierce-looking fellow, *Tabanus* sp., a red-bodied wasp *Odynerus carinatulus*, Sauss., ♀, and a Malacoderm beetle, *Melyris nobilis*, Gerst.

The easiest way down to the river at its lower level, below the Falls, is by the gorge known as the Palm Kloof,

which is separated by the "Knife Edge" from the eastern portion of the chasm. The path leads rapidly down into a wood of singularly tropical aspect, bounded on either hand by walls of basalt, and thence to the water's edge. The collecting ground is very restricted and difficult, being almost co-extensive with the steep path, so that the ratio of things taken to things seen was a low one.

The butterfly that was most characteristic of the Kloof was *Neptis marpessa*, Hopff.; it was distinctly common, and we took it nowhere else. It has the graceful sailing, *sibylla*-like flight of the genus, but is smaller than the more generally distributed *agatha*, Cram. Several males of *Leuceronia thalassina*, Boisd., were seen, all out of reach. They flew rather high, among the tops of the trees, and seemed to avoid the path. *Belenois gidica*, Godt., *B. severina*, Cram., and the wide-spread *B. mesentina*, Cram., were all met with in the Kloof; the latter, a male, flew fast. The path through the dark wood looked the very place for Satyrids, but only three were met with, two *Yphthima asterope*, Klug, one typical, the other of the var. *norma*, Westw., and a shade-loving *Mycalesis*, of which Mr. Trimen says: "near *campina*, Auriv., also like *anynana*, Butl., but the under-side very red." Our old friend *Papilio demodocus*, Esp., put in an appearance. A small, worn Lycænid, probably *Cacyreus lingens*, Cram., a male; a tailed blue, ? *Deudoryx* sp., ♀, which may possibly be new, and a male *Tarucus telicanus*, Lang, represented that group. Three large Geometers, two of them *Conolophia conscitaria*, Walk., the third a "Thorn" not yet determined, were disturbed from the herbage.

The Phytophagous beetle *Monolepta vincta*, Gerst., was abundant by a spring near the bottom of the Kloof, flying in the sun, but might also be taken by sweeping shrubs.

Of all the collecting grounds at the Victoria Falls, one naturally anticipated most from the Rain Forest; it was accordingly the first, as it was the last place that we visited. One caution is necessary *in limine:* the area of the forest is so small, and the driest of sandy areas are so near, that it cannot reasonably be expected to yield valuable evidence as to seasonal forms, for a butterfly captured within its ambit may well have gone through all its early stages outside and have merely entered the spray-bedewed area to quench its thirst. Human experience points in this direction; for it is difficult to imagine anything more

refreshing than after some hours' collecting in the drouth to allow oneself to get wet through by the spray, which was truly grateful and comforting (especially in a thirsty land where beer is two shillings a small bottle). Repeated carefully-timed experiments showed that ten minutes in the hot sun and dry wind sufficed to dry one's garments thoroughly. The chief drawback to these natural "Rain baths" was the difficulty of manœuvring a sopping net, and the condition of some of the "very dry" *B. gidica*, when taken out of the net under such circumstances was deplorable.

One butterfly did not appear to appreciate the delicious smell of the damp vegetation, at all events our old friend *Limnas chrysippus* failed to put in an appearance. The *Acrææ* too were surprisingly scarce, only single examples of *A. alboradiata*, Auriv., ♀, *A. anemosa*, Hew., ♂, and *A. atolmis*, Westw., ♀, were taken. Only one *Precis* is recorded, a ragged *natalica*, Feld., but *Neptis agatha*, Cram., was frequently seen sailing about the *Eugenia* trees. *Yphthima itonia*, Hew., was common enough, a specimen of *Y. asterope*, Klug, var. *norma*, Westw., was also taken. Another specimen was obtained of the *Mycalesis* (as yet unnamed), taken in the Palm Kloof, also one *M. safitza*, Hew. *Belenois severina*, Cram., was the commonest white; all taken were males; but extremely dry specimens of *B. gidica*, Godt. (males predominating), were fairly common, especially where the spray was heaviest. Three females of *Leuceronia thalassina*, Boisd., were taken, also a female *Glutophrissa saba*, Fabr., which was so extremely "dry" as to have lost all trace of mimicry of *Nyctemera*. Of *Terias senegalensis*, Boisd., ♀, *T. brigitta*, Cram., ♂, and *Teracolus antigone*, Boisd., ♀, single examples were secured. That only one *Teracolus* was taken is not surprising, since the genus especially haunts very dry and open places.

Papilio leonidas, Fabr., flew slowly about the *Eugenia*, with the manner of a Danaid, but the model, if such there be, was not seen; * two specimens were secured.

Zizera lysimon, Hübn., met with occasionally in all the Zambesi hunting grounds, was really common in the Rain Forest only, probably the other places were too dry for it. Of other Lycænids single examples only were taken, to

* In North-East Rhodesia, on the Chambezi, some 700 miles away, it flies with and appears to mimic *Tirumala petiverana*, Dbl. and Hew. See also Trimen, "South-African Butterflies," vol. III, 1889, p. 213.—F. A. D.

wit, *Tarucus telicanus*, Lang, ♂; *Everes cissus*, Godt., and *Catochrysops malathana*, Boisd. (= *asopus*, Hopff.), the last-named sitting head downwards.

Somewhat unexpectedly we found Skippers commoner within the range of the spray than outside, the following presenting themselves: *Parnara mathias*, Fabr., a male and two females; *Gegenes zetterstedti*, Wallgr. (= *hottentota*, Latr.), three; *Parosmodes morantii*, Trim., one, a species represented in the National Collection by a single specimen from Mashonaland presented by Mr. G. A. K. Marshall; and one *Baoris fatuellus*, Hopff.

It is curious that two Humming-bird Moths of different species were taken close together, and within a minute or two, *Macroglossa trochilus*, Hübn., and *Aellopus commassiæ*, Walk. It is also curious that no smaller moths were brought from the Rain Forest. On the other hand *Diptera* were numerous; of these the most striking were two species of the strange stalk-eyed genus *Diopsis*; one, near to *dubia*, Bigot, was to be got in abundance by sweeping in the drier parts of the Forest, the other Mr. G. H. Verrall thinks may be *ichneumonea*, Linnæus' long-lost type of the genus. Of another fly, distinguished by its apple-green abdomen, *Odontomyia* sp., several were obtained by sweeping in moister places. The same method produced other flies, among them a specimen which Mr. Verrall thinks may be a local race of *Syrphus balteatus*, Deg., and four *Sepedon* sp.

A species of *Plecia*, with a reddish thorax, was flying lazily about the *Eugenia* trees in large numbers, with its legs trailing behind just as *Bibio marci*, Linn., does in English woods in April. Then there was a pretty black-and-white *Tabanus* sp.; a pair *in cop.* of another *Plecia*; two specimens, a ♂ and a ♀, of an Asilid that is perhaps *Promachus rüppelli*, Liv., but may be new, unfortunately taken without prey; a Syrphid, *Helophilus* sp., near to but not identical with *africanus*, Verrall; lastly, something extremely like *Musca domestica*, Linn., was taken!

As might have been expected Dragon-flies were fairly numerous, prominent amongst them the large and handsome *Pseudomacromia torrida*, Kirby, flying in the open swampy space between the belt of *Eugenia* trees and the edge of the chasm; other species were *Phyllomacromia trifasciata*, Ramb., and (by sweeping) the Agrionid, *Brachybasis rhomboidalis*, Beauv., which appears to have a wide distribution in Africa.

Two wasps were taken, *Eumenes tinctor*, Christ, and *Ammophila beniniensis*, Pal. de Beau., both females, while sweeping produced an Ichneumon. Ants were represented by a solitary *Camponotus* sp., of which Col. C. T. Bingham writes, "New, but as a single specimen I cannot venture to describe it: allied to *C. sericeus*, Fabr."

The *Orthoptera* if not numerous were variously represented by a *Mantis* larva obtained by sweeping; four *Blattæ* of the genus *Ischnoptera* n. sp. (near to *bimaculata*, Gerst.), found under stones and running very rapidly away when disturbed; sweeping yielded also many grasshoppers, one of which had head and thorax conspicuously marked by two lateral yellow stripes. The locust *Prototettix impressus*, Stål., was taken on a tree.

Two very active little bugs were found under stones or leaves when looking for beetles, another was adorned with a red abdomen. Sweeping as usual yielded sundry Homoptera. The same operation produced a few beetles: a *Lagria* sp., in the collection at South Kensington, but unnamed, of which five specimens were obtained; a single *Cryptocephalus callias*, Suff.; two of the Phytophagid *Lesna chalcoptera*, Lac.; six *Haltica indigacea*, Illig.; two *Hispa* sp., also one *H. bellicosa*, Guér., of which the National Collection has specimens from the Gold Coast only. Lastly three Staphs, *Osorius rugiceps*, Boh., were found under dead wood.

In such a spot it was but seemly to find an Amphibian, accordingly we may note that a toad-like frog was abundant among the marshy spray-drenched grass between the Rain Forest and the Chasm. Many of these were extremely small, hardly larger than blue-bottles. A large specimen evacuated a mass of elytra, etc., of *small* beetles, apparently mostly geodephagous but some perhaps phytophagous; this was interesting, in so far as it bore out our experience that the Coleoptera of the Forest were very small.

Three species of land-snails were found in the Rain Forest; two turreted forms, *Opeas octona*, Chem., under stones, and the transparent *O. mamillata*, Craven, in like situations, both gregarious. Sweeping grass yielded the delicate, transparent, horny *Succinea ? badia*, Mor., very near to the British *S. putris*, Linn.

A Barotse boy, a servant of Mr. Allen's, collected for us a number of *Paludina capillata*, Frauenfeld, but exactly where he found them is not on record.

INSECTS TAKEN ON THE RAILWAY JOURNEY FROM THE VICTORIA FALLS TO EAST LONDON.

September 20th, 1905.

MATETSI STATION. 230 m. from Bulawayo.

Precis cebrene, Trim., seen.
Lycæna (*Castalius*) *hintza*, Trim., ♂, one.
Pseudagrion ? *deckeni*, Gerst. A small dragonfly, the colour of dead grass.

KATUNA STATION.

Precis cebrene, Trim., one, ♀.

NORTH OF DEKA STATION.

Glyphodes negatalis, Walk., a Pyrale of very wide distribution (of the sub-genus *Dysallacta*, Led.), taken in the train by Mr. D. Gunn.

DEKA STATION.

Limnas chrysippus, Linn., ♀.
Lycæna osiris, Hopff., ♂, at water.
Lycæna asopus, Hopff., ♂, do.
Eumenes lepeletieri, Sauss., ♀, at water, a yellow wasp with a black cross on the abdomen.

WANKIE STATION. 212 m. from Bulawayo. 2,450 feet.

Teracolus antigone, Boisd., ♂.

LUKOSI STATION. 196 m. from Bulawayo.

Anisodactylus nitens, Pér., Carabid beetle, under a stone.

INYANTUE STATION. 177 m. from Bulawayo.

Sphingomorpha chlorea, Cram., a Noctua that truly deserves its generic name, caught at light in the train by Mr. D. Gunn.

S. OF INYANTUE.

A Dipteron, *Argyramœba* sp., in the British Museum unnamed.

MALINDI STATION. 147 m. from Bulawayo.

An Ant-lion, *Myrmeleon* sp., at light in the train.

September 21st, 1905.

BULAWAYO. Lat. 20° 9′ S. Alt. 4,470 feet. Near the railway station.

Acræa doubledayi, Guér.; also the widely distributed Lady-bird *Exochomus nigromaculatus,* Goeze, a bug, and some unnamed *Orthoptera,* all taken by sweeping.

PLUMTREE STATION. S. RHODESIA. 4,560 feet. 65 m. S. of Bulawayo.

Acræa doubledayi, Guér., ♀, fluttering close to the ground.

Axiocerces harpax, Fabr., on the flowers of a yellow composite.

September 22nd, 1905.

TSESSEBE STATION. 94 m. S. of Bulawayo. 3,900 feet.

The ant *Camponotus fulvopilosus,* De Geer, running on the ground.

SHOSHONG ROAD STATION. Near the tropic. 3,250 feet.

A number of the ant *Camponotus maculatus,* Fabr., under the bark of a log.

ARTESIA STATION. BECHUANALAND. Lat. circa 24° S. 3,100 feet.

Teracolus antigone, Boisd., ♂.
Zeritis simplex, Trim., ♂.
Spindasis ella, Hew.
Stugeta bowkeri, Trim.
Syrichthus [*Pyrgus*] *sataspes,* Trim.
Gomalia albofasciata, Moore, a dwarf.

The two Skippers were taken at water, as well as the wasp *Eumenes lepeletieri,* Sauss., ♀, and the common bee *Apis mellifica,* of the usual S. African form.

MOCHUDI STATION. BECHUANALAND. Lat. 24° 22′ S. 3,100 feet.

Acræa anemosa, Hew., ♀, drinking at the drip of a tap.
Zeritis molomo, Trim., ♀.
Hesperia spio, Linn., at the flowers of a small yellow *Hibiscus.*

CROCODILE POOLS STATION. About Lat. 24° 40′ S. 3,300 feet.

A beetle, *Zophosis* sp., not in the British Museum Collection, was taken running rapidly over the sand, which when alive it exactly matched in colour.*

OOTSI STATION. Lat. 25° 0′ S. 3,620 feet.

Axiocerces harpax, Fabr., a female taken and another seen at a shrub with flowers forming yellow tails. A bug and a small Lady-bird, *Scymnus* sp., taken at *Combretum* flowers.

PITSANI STATION. Lat. 25° 26′ S. 4,420 feet.

Semiothisa brongusaria, Walk., a boarmid, at light in the train.

The two beetles *Lyctus* sp. and *Bostrychus brunneus,* Murray, a Malacoderm, were taken this day somewhere in British Bechuanaland, but the exact locality was not recorded.

MAFEKING. Lat. 25° 56′ S. 4,190 feet.

Sterrha sacraria, Linn. (1), *Crambus tenuistriga,* Hmpsn. (1), and two other moths, taken at lamps in the town. The S. African specimens of the first-named are much less beautiful than the European, as they lack the crimson.

WARRENTON STATION. 28° 11′ S. 3,930 feet.

Sept. 23, 1905. *Hesperia* (*Syrichthus*) *spio,* Linn. [= *vindex,* Cram.], one at water.

POKWANI. 28° 43′ S. 3,650 feet.

The ubiquitous *Utetheisa* (*Deiopeia*) *pulchella,* Linn.

Sept. 23, 1905. ORANGE RIVER STATION, Cape Colony, lat. 29° 38′, S.; alt. 3,540 feet, an ichneumon, and at KRANSKUIL, lat. 29° 51′ S.; alt. 3,700 feet, a number of Phycids were taken at the train lights.

* Many black beetles cover themselves with fine particles of the sand on which they live, and so easily escape observation. This I frequently noted in 1905 among the many *Heteromera* that are found on the outskirts of the Sahara at Biskra. Whether the fine particles merely fill in the interstices of the sculpture, or are attached by a secretion, I was not able to determine, but in any case they were easily rubbed off in the killing-bottle, or when handled.—G. B. L.

Sept. 24, 1905. SHANKS STATION (E. of Steynsburg Junction), c. 5,000 feet; a cricket was found under a stone, and in like situations six beetles, *Trigonopus*, sp., not in the National Collection; the Carabids, *Harpalus xanthographus*, Wied., and *H. sub-aëneus*, Dej.; and the Chrysomelid, *Polysticta 24-signata*, Thunb., three specimens; as well as a number of the pungent ant, *Acantholepis vestita*, Smith.

HANNINGTON STATION., alt. 5,170 feet; the same *Trigonopus*, another *Polysticta 24-signata*, Thunb., and *Harpalus fusco-aëneus*, Dej., were found under stones.

CONTAL STATION, a few miles East of Hannington, alt. c. 5,200 feet; under an old sleeper, three beetles were taken: the same *Trigonopus* that had been met with earlier in the day, *Harpalus rufo-cinctus*, Chaud., and a Carabid near to *Percus*, not in the British Museum.

STORMBERG JUNCTION, lat. 31° 28′ S.; alt. 5,300 feet; a few hundred yards from the station we saw swarms of a purplish-grey locust with yellowish-drab wings and yellow hind tibiæ, *Acridium pardalinum*, Walk. We had seen several flights shortly before reaching the station, but now we got amongst them. They did not fly very far, and the swarms were many rather than excessively large. The wings of those captured were much frayed, presumably by long flight and knocking against obstacles, but it is quite possible that individuals with damaged wings were more easily caught than the sounder specimens.

Turning over stones was fairly productive, as it yielded *Harpalus rufo-cinctus*, Chaud. (= *rufo-marginatus*, Boh.), seven; *H. natalensis*, Boh., four; *H. clavipes*, Boh., two; *H. sub-aëneus*, Dej., two; *H. fusco-aëneus*, Dej., three; the red and black *Hister cruentus*, Erichs., four under one stone; two other Carabids not yet named; *Polyhirma gracilis*, Dej., one; the two weevils, *Rhytirrhinus lituratus*, Fåhr., and *Stramia ? fåhræi*, Fst., one each, as well as an immature female of *Blatta orientalis*, Linn., and two very large ants, *Acantholepis vestita*, Smith. A specimen of *Pyrameis cardui*, Linn., was taken on the hill-side, but the day was scarcely fitted for butterflies.

LOWER INCLINE STATION, c. 4,500 feet; five or six specimens of *Polysticta 24-signata*, Thunb., were found close together under a stone.

QUEENSTOWN, Cape Colony, lat. 31° 50′ S.; alt. 3,500 feet. In the Public Gardens just before dark a large

? *Plusia*, or small ? *Sphinx* was seen at Verbena flowers, but missed. Shortly after leaving the station two of the widely distributed Crambid, *Eromene ocellea*, Haw., flew to the lights of the train.

East London. Lat. 33° S. Sea level.

SECOND VISIT. Sept. 25–29.

Six weeks had elapsed since our first flying visit to this place. After an unusual drought it had rained the day before our arrival, and it was blowing a violent gale when early in the morning we came to the end of our long railway journey of six days and six nights. The gale terminated with heavy rain that greatly damaged the condition of the butterflies. One victim of the flood, a female Saturnid, *Arina forda*, Westw., was rescued from drowning.

A good deal of our time was spent on our old ground in the Queen's Park. The Poinsettia flowers were over: energetic sanitary reformers had nearly completed the covering in of the unsavoury stream, but the operations of the Kaffir workmen had wrought sad havoc in some of the best collecting ground.

Mylothris agathina, Cram., did not appear to be nearly so common as before, but perhaps this was owing to the absence of Poinsettia flowers to assemble them. There was however no doubt that the closely allied *M. rüppellii*, Koch., was common enough. The males of both these allied species have a strong and seemingly identical sweet-briar-like scent. The very local and singularly elegant *M. trimenia* was quite common, both sexes being well represented.

Belenois severina, Cram., and *B. zochalia*, Boisd., were both very common; of the latter the females seemed to be more numerous than the males, perhaps because more distinctly coloured.

The beautiful *Eronia cleodora*, Hubn., was quite common. A few *Pinacopteryx charina*, Boisd., were taken, all "dry"; a male *Byblia goetzius*, Herbst, significantly a very fresh specimen, was distinctly of the wet form, but, with this possible exception, there was no evidence that the recent rains had produced any change of type, probably there had not been sufficient time. The only *Teracoli* noticed in the park were a male *achine*, Cram., and several *omphale*,

Godt., of both sexes. These *Teracoli,* with one exception that was intermediate, were decidedly "dry," but not so extremely so as our Rhodesian specimens. *Colias electra,* Linn., was seen but not taken.

Of *Papilio nireus,* Linn., form *lyæus,* Dbl., we secured two males, but we met with both sexes of *P. demodocus,* Esp. Of *P. dardanus,* Brown, perhaps the commonest of the three Papilios, two males and one female were taken, the latter of the form *cenea,* which mimics *Amauris echeria,* Stoll. Of the last-named species four specimens were taken, also three of the closely allied *A. albimaculata,* Butl. Both forms are very hard to kill. *Limnas chrysippus,* Linn., was fairly common.

Lycænids were not so numerous as might have been expected in the Park, either as regards species or individuals. Of *Zizera lysimon,* Hübn., and *Cacyreus palemon,* Cram., single specimens were taken; females of *Argiolaus silas,* Westw., were fairly common, they flew high and settled on the tops of trees, but also visited flowers. A few of the widely ranging *Tarucus telicanus,* Lang, were to be seen, two of them whilst at rest were observed to move the hind-wings alternately backwards and forwards in their own plane.

On the occasion of our former visit we saw no Satyrids, but this time two specimens of *Pseudonympha cassius,* Godt., turned up, as well as two females and a male of *Mycalesis safitza,* Hew.

With the exception of *Charaxes varanes,* Cram., which was fairly common, though worn, the Nymphalines were not very prominent. *Eurytela hiarbas,* Dru., was less plentiful and in less good condition than on our first visit; of *Byblia goetzius,* Herbst, only a single male was seen, while a *Precis archesia,* Cram., was taken settled on the ground. Several fine *Pyrameis cardui,* Linn., were observed.

Among the flowers introduced into the garden portion of the Park, and tending to run wild, was the "Pride of Madeira," *Echium fastuosum,* a remarkable plant of the natural order *Boraginaceæ,* whose small white or blue flowers form solid spikes, often six feet high or more, the apparently simple spikes being made up of innumerable densely packed scorpioidal cymes. This proved very attractive to insects of all orders; among the numerous butterflies that fed upon the flowers was a single example

of the pretty Vanessid, *Hypanartia hippomene,* Hübn. The following insects were also taken on the spikes :—*Apis mellifica,* Linn., race *adansonii,* Latr., as was only to be expected; a Longicorn *Syssita vestigialis,* Pascoe; the Cetoniids *Oxythyrea marginalis,* Schönh., *Comythovalgus fasciculatus,* Schönh., and *Strengophorus flavipennis,* G. and P.; the first was abundant, the creamy white spots on a dark ground-colour greatly aiding its concealment.* In addition there were on the same flowers a fly of the genus *Catabronta,* three of the genus *Idia,* and another fly, the latter held in the clutches of a green spider with red-brown markings, which was practically invisible among the crowded flowers; the very small bee *Prosopis sandaracata,* Bingh., was abundant, as was also the prettily marked *P. 5-lineata,* Cameron; but of *Prosopis simplex,* Bingh., n. sp., unfortunately only a unique example was secured; finally there was a sawfly, *Athalia himantopus,* Klug, ♀.

Two specimens of *Gegenes zetterstedti,* Wallgr., were the only Hesperids noted; this species settles with the fore-wings raised, the hind-wings nearly horizontal, like several of our English Skippers.

The following moths were taken, but doubtless the list might easily have been lengthened especially if we had worked at night:—*Macroglossa trochilus,* Hübn., at flowers in the late afternoon; *Syntomis kuhlweini,* Lefebr.; the day-flying Lymantriads *Laelia punctulata,* Butl., and *Aroa discalis,* Walk., males of the latter species were very common on the outskirts of the Park; the Geometers *Zerenopsis leopardina,* Feld., fluttering near the ground; *Craspedia internata,* Guen. (= *strigulifera,* Walk.), and the variable *Semiothisa brongusaria,* Walk.; we also kicked up a Pyrale, *Pyrausta incoloralis,* Guen., and two specimens of the Boarmid *Obocola inconclusaria,* Walk., one of each sex.

As usual the most obvious representatives of the *Hymenoptera* were the handsome Carpenter-bees, *Xylocopa caffra,* Linn., ♀; *X. fraterna,* Vachal, a male said by Col. Bingham to be not typical; *X. divisa,* Klug, ♀; and *X. flavo-rufa,* De Geer, four females; the last two species were practically confined to the purple flowers of a Leguminaceous shrub; *flavo-rufa* has a strong odour like our English Bumble-bees. Other Aculeates taken were the long-

* See Longstaff, Trans. Ent. Soc. Lond. 1906, pp. 91–93.

pedunculated wasps *Belonogaster praunsi*, Kohl (said by Col. C. T. Bingham to be not typical); the slender dark-blue-winged *Eumenes tinctor*, Christ, of both sexes, one male specimen, very starved, of Saussure's variety; the dull grey *Icaria cincta*, Lepel., ♀; *Pompilus ruficeps*, Smith, a female; a male *Pompilus* which is possibly new; *Polistes marginalis*, Fabr., ☿; *Larra agilis*, Smith, a female, taken on a bank of dry earth; a Scoliid, *Chalicodoma cœloccra*, Smith, a male, taken at the purple flowers along with the *Xylocopæ*. To these must be added ants from a community of *Camponotus maculatus*, Fabr., and a fine specimen of the coral-red Braconid *Iphiaulax whitei*, Cameron.

The handsome *Eristalis tæniops*, Wied., was conspicuous among the flies, which were not very numerously represented; another fly to which Col. Yerbury has been able to assign a name is *Chætolyga dasyops*, Wied. Other flies were ? *Syrphus* sp., *Idia* sp., and two *Bibio*-like *Plecia* sp., which floated in the air almost stationary with their long legs hanging down; sweeping yielded a *Diopsis*, but in this case only a solitary example which Mr. Verrall thinks distinct from the others.

The wide-ranging grasshopper *Catantops melanostictus*, Schaum, was abundant. On the leaves of "Pride of Madeira" were marshalled a number of immature specimens of a gregarious dark orange-striped Acridian, the same species that was seen at Bulawayo.

Although beetles were not numerous in the Park, we took, in addition to the Cetoniids previously mentioned, the following species:—*Macroma cognata*, Schönh., a handsome dark olive and yellow Cetoniid, flying at flowers; a Lycoid, *Haplolycus*, sp., a Cetoniid, *Gametis balteata*, De Geer, with similar colouring to the last, taken flying around or settled on the flowers of the same tree, together with a similarly Lycoid-coloured Braconid, *Zombrus* sp.; the Longicorns, *Promeces iris*, Pascoe, and *Alphitopoda maculosa*, Pascoe, var., by beating; *Trigonopus marginatus*, Wied., several under stones; also under a stone the Staph *Xantholinus hottentotus*, Sachse; a Phytophagid not in the National Collection, *Atechna inenærabilis*, Vogel, var.; *Apoderus nigripennis*, Fabr.; the metallic green *Colaspo-soma flavipes*, Har.; the Cassid *Aspidomorpha silacea*, Boh. [=*tecta*, var. Boh.]; and a weevil, *Balaninus apicalis*, Fâhr, var. B., was obtained by beating.

Two bugs complete the list of insects taken in the Queen's

Park:—a black Pentatomid with red-tipped antennæ, *Aspongopus lividus*, Dist., and a large Coreid, *Carlisis wahlbergi*, Stoll, dark brown with red-ringed antennæ, a very striking thing on the wing, but very stinking in the net.

On Sept. 27, by the kindness of Mr. John Wood, accompanied by Mr. Rattray we spent a very pleasant afternoon on the NAHOON RIVER, a few miles to the north-east of the town. We were somewhat late in the day and a strong wind was another adverse condition, so that we got very few butterflies.

On the island where we lunched *Belenois severina*, Cram., was abundant, and *Mylothris rüppellii*, Koch, the only representative of the genus, was common; *Pinacopteryx charina*, Boisd., *Eronia cleodora*, Hübn., and *Atella phalanta*, Dru., also occurred. A geometer, *Ectropis spoliataria*, Walk., a small Noctua, *Metachrostis corniculans*, Wallgr., and a very handsome Agaristid, *Xanthospilopteryx africana*, Butl., taken off a tree-trunk, completed the Lepidoptera on the island. Sunning itself on another tree-trunk close by was a beautiful green Hymenopteron, *Ampulex mutilloides*, Kohl, ♀. Mr. Rattray caught a specimen of the scarlet Braconid, *Iphiaulax whitei*, Cameron, which appears to be common in South Africa.

Mr. Wood set a stalwart Kaffir to work with an axe to hack to pieces dead trees. This did not prove a very productive operation; moreover of the creatures found but a small proportion have yet been named. Among the beetles were single specimens of the Longicorn, *Promecidus chalybeatus*, White; the Sternoxid *Alaus mœrens*, Germ., and a species of *Notiophygus*. *Blattæ* were numerous, Mr. R. Shelford has named for us *Hyposphæria stylifera*, Burm., immature; *Derocalymna ? brunneriana*, Costa, several; also *Pseudoderopeltis albilatera*, Stål., two specimens, and *P. wahlbergi*, Stål., a male. Bugs were represented by a singularly flat form, well adapted to its life under bark. It goes without saying that woodlice were plentiful.

Taking a boat the Kaffir pulled us a mile or two down the river and we landed on the eastern bank, where rich flowery meadows promised great things, but the rising of the wind and the lateness of the hour led to disappointment. A single *Teracolus achine*, Cram., ♂, a Boarmid moth, *Osteodes turbulenta*, Guen., and a Pyrale, *Antigastra morysalis*, Walk., were the only *Lepidoptera* that we brought

away from a spot which under more favourable conditions should swarm with them. Beetles are somewhat less susceptible, and we took on flowers the pretty Cetoniid *Oxythyrea hæmorrhoidalis*, Fabr., together with the commoner *O. marginalis*, Schön., also the Longicorn *Hylomela sexpunctata*, Fabr., which closely mimics a species of *Mylabris* (or ? *Ceroctis*) that we met with in South Rhodesia.

Sweeping added to the list the Lady-birds *Atechna hebe*, Clk., and *Cryptocephalus flavago*, Suff., the Weevil *Ellimenistes squamifer*, Boh.; and the *Phytophaga*, *Ootheca lævipennis*, Jac., *Gynandropthalma malvernensis*, Jac., var.; *Luperus inconspicuus*, Jac., as well as a rather pretty bug *Veterna sanguineirostris*, Thunb., the common grasshopper *Catantops melanostictus*, Schaum, and the locust *Prototettix impressus*, Stål.

We took two pedunculated wasps, *Belonogaster praunsi*, Kohl, and *Ammophila ferrugineipes*, Lepel., a male; also an Ichneumon, and a number of ants, *Cremastogaster sordidula*, Nyl., var., and *Pheidole irritans*, Smith, of which last the soldiers alone have big red heads.

Turning over stones yielded the beetles *Trigonopus marginatus*, Wied., and *Lissogenius conspersus*, Burm., as well as the common South African Reduviid bug *Physorhynchus crux*, Thunb., and two scorpions.

A specimen of the Scarab *Syrichthus spurius*, Burm., was picked off the ground, while Mr. Rattray found a specimen of the large thick-legged Coreid bug *Rhyticoris terminalis*, Burm., also a large weevil with very hard integuments, *Mecorhynus loripes*, Schönh., and two millipedes whose integuments turned the point of a No. 16. pin. Mr. Wood found lying dead on the left bank of the Nahoon a Carabid beetle, *Haplotrachelus* sp., which is not in the National Collection.

The Kaffir boatman caught several of a *Psammodes* unrepresented at South Kensington, they were crawling over the rocks by the lower landing-place, nearly opposite the Boat Club House.

Lastly, on the west bank when it was quite evening a Hesperid was netted, *Sarangesa motozi*, Wallgr. (= *pato*, Trim.).

An old termitarium on the high ground above the Club House yielded, besides sundry ants, *Cremastogaster weitzecheri*, Emery, a "night-adder," a small serpent said to be very poisonous.

Since our return to England, we have been much concerned at hearing of a disastrous flood at East London, which seems to have devastated the island in the River Nahoon where some of our collecting was done, and to have caused the death by drowning of several natives, including our Kaffir boatman and his family. Much damage has been done on the banks of the Nahoon and Buffalo rivers, and part even of the Queen's Park is reported to have been washed away.

Acting on the advice of Messrs. Wood and Rattray, we spent the next day, Sept. 28, on the "SECOND CREEK" of the BUFFALO RIVER, a delightful locality. It is approached by a pleasant walk over open downs where we met our old friends *Synchloë hellica*, Linn., *Colias electra*, Linn., and *Teracolus omphale*, Godt.; after a mile or so the path enters a wood, and descends rapidly to a brawling stream, which follows an impetuous course to a fall into a tidal pool, beyond which is a flowery meadow forming the delta of the creek. The wider tracks through the upper part of the wood had a home-like feeling, and one almost expected to see "Pearl-bordered fritillaries" disporting themselves about the flowers, but instead of these we found in moist places the pretty Satyrid, *Pseudonympha cassius*, Godt. These butterflies were of less "dry" form than most that we had met with, the majority of them might be better described as "intermediate." The more generally distributed and dingy *Mycalesis safitza*, Hew., was also common; a female exhibited a supplementary ocellus on the fore-wing.

The commonest White was *Pinacopteryx charina*, Boisd., but *Eronia cleodora*, Hübn., *Belenois zochalia*, Boisd., and *Mylothris agathina*, Cram., were all present in some numbers, and one *M. trimenia*, Butl., was taken. *Teracolus omphale*, Godt., and *T. achine*, Cram., occurred in the more open places.

The *Acræinæ* were conspicuous by their absence, but the *Danainæ* were represented by *Amauris echeria*, Stoll, and *A. albimaculata*, Butl., as well as by *Limnas chrysippus*, Linn.

The only Nymphalines taken were *Byblia goetzius*, Herbst; *Atella phalanta*, Dru., and a solitary *Precis archesia*, Cram., a species which according to Mr. Brooking of East London frequents dark holes in rocks.

Lycænids were not common, a solitary *Tarucus telicanus*,

Lang, and a couple each of *Axiocerces harpax*, Fabr., and *Phasis chrysaor*, Trim., one settled head downwards, were taken.

We took four Hesperids, viz. one each of *Hesperia spio*, Linn. (= *vindex*, Cram.), *Eretis djælælæ*, Wallgr., *Gegenes zetterstedti*, Wallgr., and *Pterygospidea flesus*, Fabr. The last named after dashing about wildly settled on the *upper* side of a leaf.

But few moths were seen, and two specimens of *Osteodes turbulenta*, Guen., and the Syntomid mentioned below were all that we took.

Beetles, on the other hand, were fairly numerous. Two species of *Heterochelus* (*Hopliinæ*) were common on yellow composite flowers, buried head downwards so as to leave the hypertrophied hind-legs alone protruding like the mandibles of an ant-lion, the resemblance being increased in that by their adduction they could inflict a very respectable pinch.*

The greenish-white flowers of a climbing composite (? *Senecio* sp.) that spread in dense mats over some of the bushes by the stream were very attractive to insects. Two Aculeates, *Xylocopa divisa*, Klug, ♀, and *Eumenes tinctor*, Christ, ♀, 2, one of them a starved dwarf; the moth *Syntomis kuhlweini*, Lefebr. (one found to be in the tender embraces of a spider); the fly *Eristalis tæniops*, Wied.; the Reduviid bug *Harpactor erythrocnemis*, Germ.; two Lycoid beetles, *Acantholycus* sp. and *Haplolycus* sp., the latter numerous,† and clearly mimicked by the Cetoniid *Gametis balteata*, De Geer, were all taken off this plant, together with a Mantis that was presumably attracted by the insects rather than the flowers.‡

A soft-skinned Cantharid, *Decatoma lunata*, Pallas, looked conspicuous enough on a pale straw-yellow liliaceous flower.

The meadows by the estuary yielded a different lot of

* See Longstaff, Trans. Ent. Soc. Lond. 1906, pp. 93–95.

† A pair remained *in cop.* for at least six hours.

‡ Another small Mantis, taken on a tree, bright leaf-green in colour, was kept alive for over a week. It was seen to catch a fly by a motion of lightning-like quickness and eat it, rejecting the wings and abdomen. When approached it would smartly assume the "praying" attitude, sometimes also turning its head in the direction of the visitor. It used to clean its eyes by passing its fore-legs over them, with an action like that of a cat cleaning its face. It also cleaned its antennæ in its mouth, bringing them down by its fore-legs.—F. A. D.

things, especially Phytophaga and Weevils. Thus *Malacosoma polita*, Jac., was abundant in the flowers of an Iris, while sweeping yielded *Ootheca lævipennis*, Jac., *Cryptocephalus polyhistor*, Suff., *Trochalus* sp., 2, and the Cetoniid *Oxythyrea hæmorrhoidalis*, Fabr., as well as the following small Weevils:—*Eremnus gyrosicollis*, Boh., *Sciobius o'neili*, Mrshl., ♀, *S. pullus*, Sparr., *Strophosomus* sp., and two new species which Mr. G. A. K. Marshall has described* under the names *Elliministes callosicollis*, Mrshl. (4), and *Myorrhinus longstaffi*, Mrshl., the latter in abundance. With the beetles in the sweeping net was a Bombylius *Systœchus* sp., and two bugs, a black yellow-spotted *Stenozygum* that is possibly new, and the large pale ochreous fetid Pentatomid, *Basicryptus distinctus*, Sign.

Other beetles taken in the same locality were the Lady-birds *Chilomenes lunata*, Fabr., and *Polysticta macularis*, Dej.; *Melyris ciliatus*, Oliv., *Thysodactyla africana*, Chap.; a *Trochalus* apparently undescribed; a *Telephorus*; a *Lagria*; and a Scarabeid, *Syricthus spurius*, Burm., the last found in rotten wood.

Among *Orthoptera* were the big locust *Phymateus leprosus*, Serv., the common *Catantops melanostictus*, Schaum, *Prototettix impressus*, Stål., the handsome *Acridium ruficorne*, Fabr., so named from the red tips to the double row of white spines on its black tibiæ, and two unnamed grasshoppers, one grass-green, the other a curiously soft species, black with scarlet rings and blotches.

The only flies taken were two Bombyliids of the genus *Systœchus*, one at flowers, the other by sweeping.

A few Aculeates complete the list, viz.:—*Xylocopa flavo-rufa*, De Geer, a male; *X. divisa*, Klug, a female; the prettily variegated *Polistes fastidiosus*, Sauss., a female; the grey *Icaria cincta*, Lepel., ☿; two small black bees *Halictus deceptus*, Smith, females; lastly a fine distinct red, yellow and black wasp, which Col. C. T. Bingham has described as *Odynerus longstaffi*, from a specimen in the National Collection from Natal, hitherto unnamed, making our specimen a co-type. Lastly an example of the blue-green Chrysid *Hexachrysis simillimus*, Grib., was taken settled on a bare rock.

On our return walk we kicked up a Noctua in the wood, and as we reached its upper edge at about 3.0 p.m.,

* Marshall, Proc. Zool. Soc. Lond. 1906, pp. 922 and 932.

we found Termites on the wing in swarms; five specimens were brought home alive in separate pill-boxes, on reaching the hotel it was found that one had cast off a wing, another all four wings. Later in the afternoon *Syntomis kuhlweini*, Lefebr., was found in some numbers flying about, or settled upon a particular species of tree. The large Reduviid bug *Physorhynchus crux*, Thunb., was also taken on the wing. This insect usually carries its wings so closely appressed to the abdomen that when first seen it was thought to be apterous.

On the morning of sailing, Sept. 29, a somewhat hurried visit was paid by one of us to the scrub-crowned SANDHILLS seen from the ship that August morning when we first anchored at East London, but this expedition did not add much to our list.

Two ants turned up, *Camponotus cosmicus*, Smith, also taken at Estcourt, and *Polyrachis gagates*, Smith, of which but a single specimen was met with in this land of ants; there were also the following Aculeates: *Polistes marginalis*, Fabr., ☿, *Belonogaster guerini*, Sauss., ☿, var. *dubius*, Kohl (a very large specimen), *Eumenes tinctor*, Christ, ♀, *Icaria cincta*, Lepel., ☿, the big Carpenter bee *Xylocopa flavo-rufa*, De Geer, ♂, and two of the pretty little bees *Prosopis* 5-*lineata*, Cameron, taken at a red flowering shrub. The only other Hymenopteron was an Ichneumon with Lycoid colouring.

A fly that seemed to mimic a pedunculated wasp Col. Yerbury says may be the ♂ of *Baccha picta*, Wied., of which that author has only described the ♀ from the Congo and Guinea. Another fly taken would appear to be *Sarcophaga ? carnaria*, Linn.

Beetles proved less numerous than might have been expected: two tiger-beetles, the first we had seen in S. Africa, *Cicindela candida*, Dej., and *C. capensis*, Fabr., were common close to the sea on the bare sand, which they so closely resembled in colour as to be scarcely visible save when on the wing. Also running on the sand was a nameless *Zophosis* and an equally nameless *Anoplochilus*. The flowers of a species of Iris produced, besides abundance of *Malacosoma polita*, Jac., *Camptolenes fastuosa*, Lac.

Lissogenius conspersus, Burm., was taken flying in the sun, as was also *Scarabæus convexus*, Hausm., and the Cassid *Aspidomorpha tecta*, Boh., the latter looking like a golden spangle floating in the light. The Hopliine

Khoina bilateralis, Thunb., was found on flowers, and *Eurynotus muricatus*, Kirby, under bark.

The Coreid bug *Scrinetha amista*, Germ., seems to mimic a *Lycus*. Another bug taken was the Reduviid *Harpactor segmentarius*, Germ.

Locusts were rather common, conspicuous among them was a very fine specimen of the large, heavy and sluggish *Phymateus leprosus*, Serv., more glaucous than those taken at Ladysmith, so as to match more closely the light-coloured sand. The beautiful apple-green *Tryxalis ståli*, Boliv., darker above, paler beneath, as is so often the case, was found at the verge of vegetation, while an abundant grasshopper found on the bare sand was highly cryptic. A curiously formed small Hemerobiid Neuropteron, *Mantispa ? tenella*, Erichs., was taken on the wing; when seen for the first time its resemblance to a Mantis is very striking.

Perhaps the locality was too much exposed for butterflies, at all events they were neither numerous nor remarkable:—*Amauris albimaculata*, Butl., ♀; *Eurytela hiarbas*, Dru., within 100 yards of the sea; *Byblia goetzius*, Herbst, ♀, dry; *Pseudonympha cassius*, Godt.; *Argiolaus silas*, West., ♀; *Mylothris rüppellii*, Koch, ♀; *Pinacopteryx charina*, Boisd.; *Colias electra*, Linn.; *Teracolus omphale*, Godt., ♀, and the Skipper *Eretis djælælæ*, Wallgr. A Geometer, *Obocola inconclusaria*, Walk., ♂, and the Lymantriad *Aroa discalis*, Walk., which was common flying about the scrub, were the only moths.

The lights at the hotel yielded only *Dorylus helvolus*, Linn., ♂♂; the very widely distributed Acidaliid *Idæa fibulata*, Guen., and one or two moths not yet named.

The cosmopolitan *Dermestes vulpinus*, Fabr., shared the hotel accommodation with us, while *Acanthia lectularia*, Linn., was even more intimate!

Thus ended our delightful collecting at East London, a place less known entomologically than many others in South Africa.

Port Elizabeth, Cape Colony. Second Visit.

Lat. 34° 0′ S. Sept. 30, 1905.

The stoppage on the return voyage gave us a long morning's collecting; but an accident separated us, so that while one visited Humewood, about a mile and a half to

the south-east, the other spent his time, more profitably as it turned out, on the more sheltered slopes of the left bank of Baaken's River, just north of FORT FREDERICK. At this spot butterflies were plentiful. The males of *Colias electra*, Linn., were common, as were both sexes of *Synchloë hellica*, Linn., while *Pyrameis cardui*, Linn., was in abundance, some worn, but many in fine condition. The Skipper *Cyclopides metis*, Linn., was fairly common, but only two were taken; one *Gegenes zetterstedti*, Wallgr., a female, was taken ; but out of many Lycænids seen flying about only a single specimen of *Zizera lysimon*, Hübn., was secured. This blue was found by us over a wide range of country, but nowhere in any numbers except in the Rain Forest, Victoria Falls.

A grasshopper, *Epachromia thalassina*, Fabr., with head, thorax and jumping legs green, otherwise yellowish-brown, was also taken.

On the north wall of the Fort itself, or on the ground close by, considerable numbers of the red and brown bug *Scantius forsteri*, Fabr., were found, for the most part paired. Many of them exuded a drop of clear liquid when pinned, and in one or two a slight, somewhat offensive odour was detected.

The swampy heath-like waste beyond HUMEWOOD and the woods at the back of it proved very barren of insect life, perhaps partly from the uniformity of the vegetation, partly from exposure to the sea-winds. A few *Synchloë hellica*, of both sexes, and three or four *Pyrameis cardui*, were the only butterflies seen.

Stone-turning yielded a small beetle which Mr. L. Péringuey believes to be a new species of *Anaulacus*, but possibly a *Microus*; four *Eurynotus muricatus*, Kirby; another species of the same genus that may be new; one larva of *Luceola* sp.; also the Cockroach *Deropeltis erythrocephala*, Fabr., which, as is so common with the group, was very local and markedly gregarious.

Five specimens of an undetermined beetle were found on composite flowers. Sweeping produced a red-winged Homopteron, two dragonflies, *Sympetrum sanguineum*, Müll. (a common species), and the large and beautifully-coloured *Anax mauricanus*, Ramb.; all took some catching. A common-looking "Greenbottle," *Lucilia* sp., was taken, but the species, or others like it, was abundant throughout our journey.

The flowers of a yellow *Chrysanthemum* in the garden of the Humewood Hotel attracted a certain number of insects: *Apis adansonii*, Latr., ☿; the active green Longicorn *Promeces linearis*, Linn.; and the Hopliine *Dicranocnemus squamosus*, Burm., the last-named in abundance buried in the flowers (and in other *Compositæ*); but it was noted that their hind-legs did *not* mimic jaws.

Cape Town. Second Visit.

Lat. 34° S. October 2, 3.

One day was devoted to the ascent of Table Mountain by way of The Gorge.

Most of the collecting was along the road at about 1,200 feet above the sea. Very few butterflies were seen, a few *Pyrameis cardui*, Linn., also a few *Pseudonympha vigilans*, Trim., and a few of the Lycænid *Cacyreus palæmon*, Cram.

The fine black and white Carabid, *Anthia* 10-*guttata*, Fabr., was not uncommon running on the path;* when handled it emitted a very pungent odour (one specimen of this beetle was taken in a pine wood just above the outskirts of the town). Under stones five specimens of *Microlestia tabida*, Fabr., were taken. But the greatest numbers of beetles were found on, or actually *in* composite flowers, especially those of a species of *Senecio*. The most abundant species was the Hopliine *Heterochelus forcipatus*, Burm., a species in which the posterior legs are enormously developed in the male sex; no females were seen. With these were a few (3 ♂, 1 ♀) of the allied *Dichelus dentipes*, Fabr., of which the males have large posterior legs. There were also a number of *Encyophanes* sp. (unnamed in Brit. Mus.) of both sexes. All these were buried in the disks of the flower with only the hind-legs protruding.† A specimen of the hairy Hopliine *Anisonyx lynx*, Fabr., was taken in another composite flower (? *Gazania* sp.).

By shaking the flowers of a *Senecio* (?) into the net the following were obtained: *Ootheca tricolor*, Fabr., two; ? *Hedybius* sp., six; a very small weevil, an Erirrhinid of uncertain genus, one; *Oosomus* sp., seven; several *Telephori* and a Cricket.

* Not so swift in its movements as the Biskra species *A. sexmaculata*, Fabr. Probably the struggle for existence is not so severe on the Cape Peninsula as on the Sahara.—G. B. L.

† See Longstaff, Trans. Ent. Soc. Lond. 1906, pp. 93–95

At the flowers of a yellow leguminous shrub two workers of *Apis adansonii*, Latr., were taken, together with three bees of the genus *Megachile*, all males, all distinct species and all apparently new! However, Col. C. T. Bingham says that it is useless in that genus to name or describe males without females. It was noted with surprise that the beautiful strong-scented golden yellow blossoms of the *Protea*, a shrub characteristic of the Cape Peninsula, attracted nothing but a few flies. At about 1,400 feet *Bombylius lateralis*, Fabr., was met with, and the Satyrid *Pseudonympha vigilans*, Trim., up to 1,500 feet.

The summit, 3,600 feet, was in dense cloud, for the "table-cloth" was spread, and the only insects taken at that altitude were hairy Hopliines; two *Anisonyx lynx*, Fabr., and one *A. ursus*, Fabr.; of these two were on flowers, one on the wing.

Turning over stones at the foot of the LION HILL, c. 300 feet, yielded two ants, *Acantholepsis capensis*, Mayr.; the beetle *Oncotus tardus*, Sol.; a larva of *Luciola* sp.; and the cockroach *Temnopteryx phalerata*, Sauss.

The next day we took the train to SIMON'S TOWN, which lies about fifteen miles to the south of Cape Town. Here our collecting was confined to a strip of sandy ground with eastern aspect, close to the shore and at the foot of the line of hills capped with sandstone crags perhaps 3,000 feet in height, which overlook Simon's Bay.

As we came out of the station a large blue-black Carpenter bee, *Xylocopa capensis*, Lepel., dashed at the head of one of us; forthwith his companion made violent efforts to catch the bee, and for some time the bewildered entomologist was in considerable peril between the swoops of the net and the assaults of the Aculeate!

The Heteromerous beetle, *Opatrum* ? *arenarium*, Fabr., was common in a very sandy place under stones, and in like situation were single specimens of *Harpalus fuscipennis*, Wied., and the black and red Reduviid bug *Acanthaspis lythrodes*, Germ., of which the British Museum possesses but a solitary example.

The dry sandy soil, scorched by the sun and exposed to the sea winds, is thoroughly suited to the taste of a *Mesembryanthemum*, which grew luxuriantly, its handsome flowers attracting many insects. Among these was a Hopliine beetle, *Lepitrix lineata*, Fabr., which was very abundant at one spot close to the railway-station. Unlike

the *Dicheli* and *Heterocheli* they do not bury themselves among the stamens of the flowers, but are as active as bees, flying very readily. A few specimens were also found in the spathes of the white arum, these curiously enough did not attempt to fly. On the other hand, some small black bees with white-ringed abdomen, *Halictus albofasciatus*, Smith, ♂, did bury themselves in the *Mesembryanthemum*, but nevertheless were so active as to be difficult to catch; associated with them, closely mimicking them, and almost equally hard to catch, were some flies, ? *Ploas* sp. and ? *Prorachthas* sp. The mimicry, especially in habits, was very striking during life, yet in the cabinet the insects look distinct enough.

On other flowers such small things were found as six green beetles, ? *Hedybius* sp., the tiny *Eurysthenes balyi*, Chap., a *Eutrapela* sp., which stands without a name at South Kensington; *Attagenus* sp.; *Harpalus xanthoraphus*, Wied.; *Telephorus* sp.; the Hopliine *Pachycnema obscurepurpuria*, De Geer, a ♀, also one of each sex of a small bee, *Dasypoda* sp., which Col. Bingham says is near to *bœtica*, Spin., but distinct, and the little *Halictus terminalis*, Smith, ♀. A yellow liliaceous flower was tenanted by a small beetle, *Notoxus inconstans*, Lafert.

The black and yellow *Ceroctis capensis*, Linn., was found in the yellow flower of a prickly composite, while in the flowers of *Senecio ? concolor* (a species with purple ray-florets) were numbers of a small Heteromeron, *Notoxus* sp.

Close to the beach, running swiftly over the sand and taking the short flights so characteristic of the genus, were several *Cicindela brevicollis*, Wied. An Asilid, ? *Dysmachus* sp., was also fond of settling on the bare sand. The Elater *Œdistoma cuprea*, Linn., was also taken on the sand; during life it was of an iridescent bronze colour, which proved very fugitive.

On a tuft of grass, above the ground, a semi-papyraceous nest was found to be tenanted by a numerous community of ants, *Cremastogaster stadelmanni*, Meyr.

Lastly, on the heathy scrub on the hillside at Glencairn two Lycænids were taken, *Phasis thero*, Linn., and *Cacyreus thespis*, Linn. With them was a fly, *Hæmatopota* sp.

Just before embarking we drove down to The Flats, near Claremont, but the weather conditions were unfavourable and the results wholly disappointing. *Pyrameis cardui* and *Pseudonympha cassius* were the only butterflies

obtained; the latter was worn and appeared to be of the wet-season form. An as yet undetermined moth (? *Pseudosterrha* sp.), a grasshopper and a few very ordinary flies, *Eristalis tenax*, Fabr., *Catabomba* sp., and *Calliphora vomitoria*, Linn., were the only other things taken.

Thus ended our eight weeks in Africa, resulting in the capture of some 2,500 specimens of all orders. So extensive is the fauna and so far from being exhausted that even in this scamper (for our journey may well be so designated), several new species were taken, while there remain a number of insects not yet worked out which almost certainly include several other novelties.

Our sincere thanks are due to Professor E. B. Poulton, F.R.S.; to the assistants of the Hope Department; to Mr. C. O. Waterhouse and all the staff of the Entomological Department of the Natural History Museum; to Commander J. J. Walker, Colonel J. W. Yerbury, Mr. W. L. Distant, Mr. R. Trimen, F.R.S., Mr. M. Jacoby, Mr. G. H. Verrall, and Mr. L. Péringuey, for their assistance in naming our specimens. To Sir George F. Hampson, Bart., Col. C. T. Bingham, Mr. Guy A. K. Marshall, and Mr. R. Shelford, our special thanks are due for describing new species.

Explanation of Plate XXV.

[*See Explanation facing the* Plate.]

September 26th, 1907.

Horace Knight, del. Witherby & Co., imp.

ERONIA CLEODORA, HÜBN.
ON THE WING AND AT REST.

II. *Notes on some* Butterflies *taken in* Jamaica. By G. B. Longstaff, M.D., F.R.C.P., F.E.S.

[Read November 6, 1907.]

The island of Jamaica is 144 miles long by 49 miles wide, and comprises an area of 4207 square miles, so that it is about equal to the counties of Devon and Somerset taken together. It lies well within the tropics, being between the latitudes 17° 45′ and 18° 35′ N.

Rather more than half the total area of the island is below the 1000 feet contour line, but some 60 square miles have an altitude of 4000 feet and upwards, the highest point reached by the Blue Mountains being 7360 feet.

My most remote points were separated by 120 miles of longitude, and 40 miles of latitude, but though I spent three weeks at an elevation of 2000 feet and upwards my highest point was but 2900 feet.

As regards geological formations, I collected upon almost all those of which the island is made up, with one important exception—I did not explore the Blue Mountains, indeed there seemed to be little to induce one to do so at that time of the year.

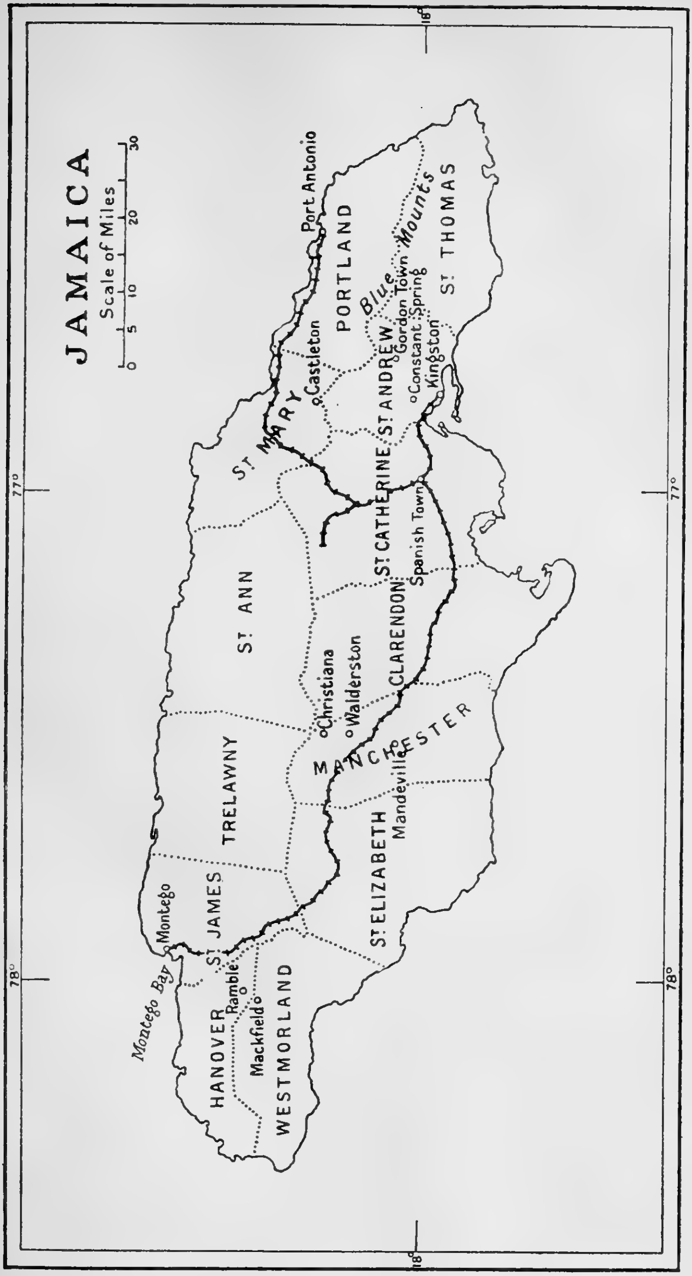
My remarks naturally enough apply to the places that I have visited, and to the times of my visits, limitations which should not be forgotten. My collecting was confined to ten weeks (Dec. 31—March 8) of the dry season, the tropical winter. However, the general aspect of the country towards the end of the dry season does not suggest to the English visitor either winter or early spring, but rather a fine, hot, late autumn, with burnt-up, gone-to-seed herbage and falling leaves. The quiet and solitude of the woods was surprising, so that the falling of a big leaf, such as are common in the tropics, would make clatter enough upon the path to give one a start. Often where trees and varied undergrowth little disturbed by cultivation suggested a profusion of insects, almost none were found. Not only were butterflies scarce, but beetles, bees, wasps, and especially flies. There is a note in my diary for Febr. 16th: "Christiana. Caught a wasp, the first I had seen since Constant Spring" (Jan. 14). During

that month I took but about half-a-dozen flies. Mr. H. P. Gosse, in his altogether admirable "Naturalist's Sojourn in Jamaica," expresses his surprise at the scarcity of insects, in words that seem to merit quotation. "I had left England with high expectations of the richness of the West Indian entomology: large and gaily-coloured beetles, I supposed, would be crawling on almost every shrub, gorgeous butterflies be filling the air, moths be swarming about the forest-edges at night, and caterpillars be beaten from every bush. These expectations were far from being realised: . . . in general butterflies are to be obtained only casually. Moths are still more rare . . . in general beetles and the other orders are extremely scarce, and especially Diptera; I have often been astonished at the paucity of these, as compared with their abundance in Canada and the Southern United States. . . . One may often walk a mile,—I do not mean in the depth of the forest, but in situations comparatively open, beneath an unclouded sun,—and not see more than a dozen *specimens* of all orders" (pp. 94, 95).

I was told that something between sixty and seventy species of butterflies occur in Jamaica, and it is a surprising fact that such a large tropical island should not produce more species than Great Britain. During my ten weeks' collecting I obtained forty-seven species, as compared with thirty-six species that are to be found in the one Devonshire parish of Mortehoe. Indeed for the most part I found Jamaica poorer in butterflies than Mortehoe in the summer. There were but two occasions on which the numbers were comparable, both near Port Antonio.

On the afternoon of February 25th I was ferried over to Navy Island. The Trade-wind was blowing rather strongly, and the only sheltered spot was some swampy ground to the leeward of a bluff; here *Anartia jatrophæ*, Linn., was in the greatest profusion, many being busy about the flowers of the Logwood-trees (*Hæmatoxylon campeachianum*, Linn.), with them were a few *Dione vanillæ*, Linn., and one *Precis lavinia*, Cram.

The other time was on March 3rd, near the top of "Shotover," to the west of Port Antonio. Here, about 1000 feet above sea-level, on a spur of a somewhat higher hill, commanding a glorious view of sea and coast, was a steep slope with an aspect a little south of east. An acre or two of this slope, partly sheltered by trees,


JAMAICA
Scale of Miles
0 5 10 20 30
Port Antonio
Castleton
PORTLAND
Blue Mounts
Gordon Town
Constant Spring
Kingston
ST THOMAS
ST ANDREW
ST MARY
ST CATHERINE
Spanish Town
ST ANN
CLARENDON
Christiana
Walderston
MANCHESTER
Mandeville
TRELAWNY
ST ELIZABETH
ST JAMES
Montego
Montego Bay
Ramble
Mackfield
HANOVER
WESTMORLAND
77°
78°
18°

displayed a greater wealth of flowers than I saw anywhere else in Jamaica, the dominant and most attractive being a species of Vervain (probably *Stachytarpha jamaicensis*, U.). It was a very hot day, with less wind than usual, and I was there from 11.15 a.m. to 12.30 noon. *Dione vanillæ* was fairly swarming, while *Euptoieta hegesia*, Cram., was scarcely less abundant, and among them were numerous *Precis lavinia*, Cram., and a few Skippers, *Prenes nyctelius*, Latr., *P. ares*, Feld., and *Morys valerius*, Mösch. *Callidryas eubule*, Linn., was coursing about in all directions, often stopping to take a sip from the Vervain; but not a single White was seen; *Colænis* was conspicuous by its absence, while *Anartia jatrophæ*, Linn., if present did not obtrude itself on my notice. A hasty glimpse of a *Papilio* was obtained, also of a butterfly that suggested my South African acquaintance, *Planema esebria*, Hew. (? *Actinote* sp.). Among the butterflies were a few of the beautiful Arctiid, *Utetheisa bella*, Linn. (*speciosa*, Walk.). Altogether it was such a sight as seldom gladdens the eye, but which happily lingers long in the memory.

A few words on the localities visited :—

Constant Spring (Dec. 31—Jan. 14); the hotel stands near the northern edge of the Liguanean plain, about 500 feet above the sea. There is good collecting in the woods at the foot of the mountains up to Stoney Hill, say 1000 feet.

Gordon Town (Jan. 9); the bed of the Hope River below the town, which I visited once, is about 800 feet.

Chancery Hall (Jan 8, also March 7), on the plain, is beside the dry bed of a stream, to the west of Constant Spring.

Temple Hall (Jan. 11, 12), c. 850, is on the road to Castleton, Jamaica.

All these places are in St. Andrew Parish. Parishes in Jamaica take somewhat the place of counties in England, and as the names are in constant use it seems well to give them.

Castleton, St. Mary Parish (Jan. 11, 12), is just beyond the height of land; the Botanic Garden is 500 feet above the sea. It proved a disappointing locality.

Mandeville, Manchester Parish (Jan. 16–22), ranges from 2000 feet to about 2200 feet. It proved very poor.

Mackfield and Ramble, close together, the former in Westmoreland, the latter in Hanover (Jan. 24—Feb. 2).

A delightful rolling country of pasture intermixed with woods. About 800–1000 feet. Unfortunately the very head-quarters of the collector's greatest foe in Jamaica—the tick.

Montego Bay, St. James (Feb. 2–5); the collecting ground ranges from the sandy shore to the top of a wooded hill of about 300 feet, and was fairly productive.

Walderston, Manchester (Feb. 6–20); the collecting ground ranged from about 2500 feet to 2900 feet (Mile Gully Mountain). An almost waterless district, but the tops of the hills covered with woods. One day (Feb. 16) was spent at Christiana in a gorge cut through Trappean Conglomerate, about seven miles to north of Walderston. Height about 2000 feet in a well-watered country.

Spanish Town, St. Catherine (Feb. 20–23); near the edge of an extensive plain, its elevation above the sea must be inconsiderable.

Port Antonio, Portland (Feb. 24—March 5); from the coast my collecting ground extended to the summits of "Shotover" on the west and Park Mount on the east, both about 1000 feet.

Speaking generally, insects were commonest near the sea and on the slopes of the hills up to 1000 feet. Flies, bees and wasps were especially scarce at 2000 feet and over.

Danainæ.

Anosia archippus, Fabr., 4 ♂. Only seen at Port Antonio. Found about *Asclepias* also at Rose and other flowers; it is hard to kill.

The Jamaican specimens of this butterfly differ from those from South America in the following particulars. They are brighter; they have less black along the veins; there is more fulvous at the tip of the fore-wing; the white spots beyond the cell are outlined (and sometimes suffused) with fulvous.

Tasitia jamaicensis, Bates. 2 ♀ near the stream which the Kingston-Castleton road crosses close by Temple Hall; a ♂ near Ramble Post Office, another ♂ near Walderston. Like the preceding, this is hard to kill.

The form met with on the mainland, *T. cresimus*, Cram., which appears to be distinct, has much more black about it, *e.g.* along the costa and the veins.

Mr. P. W. Jarvis said to me: "Neither of the Milkweed Butterflies is very common in Jamaica."

SATYRINÆ.

Calisto zangis, Fabr. 26 specimens. Very generally distributed in woods, but seldom abundant. Constant Spring, Castleton, Mandeville, Mackfield (common), Walderston (common), Port Antonio (abundant). The sexes about equally divided. It flies amongst herbage so close to the ground as to be difficult to catch, yet seldom moving many yards. It is distinctly a shade-lover. On 27th February, 1907, near Port Antonio, I saw it flying freely on a rainy day.

HELICONINÆ.

Heliconius charithonia, Linn. 21 specimens. Generally distributed throughout the island and not uncommon. Constant Spring, Castleton (common), Mackfield, Walderston, Christiana, Montego Bay, Port Antonio (common).

This butterfly has usually a slow flapping flight often in half-shade. It is distinctly local, in the sense that it is confined to a very small area in each locality; sometimes it may be seen flying up and down a very short beat. It settles on flowers and leaves with wings fully expanded.

Mr. P. W. Jarvis, of the Colonial Bank, told me that the butterfly was very common later in the year, and that it "clustered" on going to rest for the night; a number of specimens sitting close together, but not actually clinging to one another. On 5th March, 1905, at "Shotover," near Port Antonio, close upon 1000 feet above the sea, at about noon on a dull day, eight or ten were seen flying about under the shelter of a hedge. As many as seven of these settled on dead sticks, etc., within a space of 2 feet by 1 foot. This butterfly is somewhat hard to kill.

As compared with Venezuelan specimens, those from Jamaica have all the yellow marks a little larger; and the red spot near the base of the cell of the hind-wing is smaller, or even absent.

NYMPHALINÆ.

Colænis cillene, Cram. (should not the name be *cyllene*?), 12 ♂, 4 ♀. Generally distributed and not uncommon. Constant Spring (common), Castleton (common), Mackfield, Montego Bay, Walderston, Port Antonio.

A grand insect on the wing, sailing about like a piece of rich gold. The imperfect condition of many of the specimens is not apparent during its strong flight. It is

most easily taken at flowers such as *Lantana camara*, Linn., and *Eupatorium odoratum*, Linn. One specimen appears to have been bitten by a lizard.

The male is distinguished from that of the South American *C. delila*, Fabr., by its more orange tint and the comparative absence of black; but *cillene* should perhaps be looked upon as a local race of *delila*.

Dione vanillæ, Linn. 16 ♂, 7 ♀ Generally distributed and in some places very abundant. Constant Spring (common), shore of Port Royal harbour, Mandeville (abundant), Ramble (abundant), Montego Bay, Walderston, Spanish Town, Port Antonio (swarming on "Shotover").

A brilliant insect appearing very red upon the wing and reminding me of an *Acræa*. Although it could fly about wildly enough, several males were seen one afternoon fluttering among dead leaves close to the ground.

I do not detect any difference between Jamaican and South American specimens, save that the former are usually smaller and often brighter.

Euptoieta hegesia, Cram. 12 specimens. Widely distributed but in most places scarce. Constant Spring, Temple Hall, Montego Bay (common near the hotel, also found on the sandy shore), Walderston, Port Antonio (common in a swampy meadow near the shore to the east, but in swarms on the top of "Shotover").

This insect reminded me of *Atella phalanta*, Drury.

Jamaican specimens have the orbicular and reniform stigmata less clearly outlined than those from the Spanish main; moreover the ground-colour is a brighter tawny.

Phyciodes frisia, Poey. 5 specimens. This little butterfly was confined to the Liguanean plain and the hills bounding it on the north, and was not common.

Constant Spring, Stoney Hill, near Gordon Town, Spanish Town.

Precis lavinia, Cram. 8 specimens, all males. Constant Spring, Chancery Hall, Mandeville, Port Antonio. It usually settles on or near the ground, frequenting hot, dry, exposed places. Is wary and not easy to catch.

The nomenclature of this very variable and wide-ranging species (from the Southern United States to the Argentine) has long been in great confusion, but has been cleared up by Mr. Guy A. K. Marshall, who has recently re-arranged the genus in the National Collection. Cramer

named three forms of this genus, all from Surinam, *lavinia*, *evarete* and *genoveva*. It appears to me that Mr. Marshall is quite correct in uniting these under the first name, together with the Northern form *cœnia*, Hübn. (the name adopted by Messrs. Godman and Salvin in the "Biologia Cent. Am.").

Jamaican specimens, usually known by local collectors as *Junonia genoveva*, Cram., are, as a rule, brighter than South American, with the transverse white band near the tip of the fore-wing fairly conspicuous, being of the form *zonalis*, Feld.* They are somewhat intermediate in character, between the South American and North American forms, to which latter specimens in the Hope Collection from the Bahamas approach more nearly.

Anartia jatrophæ, Linn., var. *jamaicensis*, Möschler. 8 ♂, 7 ♀. Widely distributed and abundant. Constant Spring, Castleton, Mandeville, Mackfield, Montego Bay, Walderston (scarce), Christiana, Port Antonio.

It is *par excellence* the common road-side Butterfly of Jamaica. A somewhat ghostly looking insect on the wing; when settled among whitish dead grass, with wings closed, it is very cryptic. It usually settles on the ground or close to it and does not frequent flowers much.

Jamaican specimens are all very readily distinguished from those from South America by the broad bright fulvous, or orange brown, margin to the wings. There is a mere trace of this colour in specimens from the mainland, which moreover appear to be less densely scaled.

Cystineura dorcas, Fabr. (*mardania*, Cram.). 22 specimens. Local; Constant Spring, Gordon Town, Mackfield (abundant), Williamsfield Cave, Montego Bay, Port Antonio (common).

This delicate and very distinct butterfly, which somewhat resembles a Satyrid, frequents moist, shady places with long grass. There is sometimes much fluttering in its very slow flight, but at other times it glides. Though not such a flower-lover as many Nymphalines, it often visits the Spanish Needle, *Bidens leucanthus*, W. It usually settles with its wings wide open, and if it close them up re-opens them quickly. On 1st February, 1907,

* H. Fruhstorfer (Stett. Ent. Zeit. 1907, p. 224) comes to the same conclusion as Marshall as to Cramer's three forms, but makes the Cuban form (*zonalis* according to Marshall) a new sub-species *michælisi*.

near Chichester Rectory, Ramble, two were beaten out after sundown; both settled almost at once, one on the top of a grass stem with its wings up, the other towards the top of a long green fern. The second very deliberately set up its wings, then after an interval it retracted its fore-wings so as to conceal the large white patch. I failed to find any naturally at rest.

It may be noted that *C. cana*, Erichs., the representative of *C. dorcas* on the mainland, lacks the conspicuous orange brown of the latter species.

Victorina stelenes, Linn. (So spelled by Linné; Mr. Kirby has it *steneles*; probably Linné meant to call it after either Sthenelus or Sthenele, the other names are meaningless.) 11 specimens. Widely distributed, but not common. Constant Spring, Mackfield, Walderston, Christiana, Spanish Town, Port Antonio. On the banks of the Rio Grande, on 2nd March, I saw four or five flying together about a bush of what I took to be the Rose Apple (*Jambosa vulgaris*, D.C. = *Eugenia jambos*, Linn.).

Cabinet specimens give little idea of the beauty of this butterfly during life, since its lovely green fades rapidly. Bold, like many of its family, it will return again and again to the same perch, often a dark-green leaf at or above the level of the eye. Sitting there with its wings three-quarters open it is a truly beautiful object, yet not nearly so conspicuous as might be thought, and this is true whether its wings be open or closed, whether at rest or in its rather slow flight. One courageous specimen settled first at my feet and then upon my net!

In Jamaican specimens the fulvous spot at the anal angle of the hind-wing is larger and brighter than in South American; there is also somewhat more fulvous on the underside, the bands being broader.

Aganisthos orion, Fabr. (*odius*, Fabr.). 5 specimens. This very fine and robust Butterfly was only met with to the west of Port Antonio near the sea-level.*

It is quite probable that sundry large brown butterflies

* Messrs. Godman and Salvin ("Butterflies of St. Vincent, Grenada, etc.," Proc. Zool. Soc. Lond. (1896), p. 515) say: "Grenada. Two specimens of this common species, which is also found in Hispaniola, but in no other West Indian island that we know of." It is, however, one of the few butterflies named by Gosse ("A Naturalist's Sojourn in Jamaica" (1851), p. 99).

seen at Ramble and Walderston may have belonged to this species or the next.

A strong flier frequenting the tops of trees, especially the Star Apple, *Chrysophyllum cainito*, Linn., on the leaves and fruit of which it occasionally settles. More frequently it is seen to rest on tree-trunks (in particular the Logwood, *Hæmatoxylon campeachianum*, Linn.), on posts or buildings within a few feet of the ground, always with its head downwards and wings closed over its back. When thus settled it may be detected, when seen in profile, at a considerable distance in spite of its cryptic coloration. It is not easy to catch even when settled, and I spent much time over it. One of my specimens seems to show a bird-bite at the usual corner of the hind-wings.

In the Jamaican specimens the fulvous band across the fore-wing is much broader than in those from the mainland; there is also a tendency for the fulvous on the hind-wing to be more extended.

Cœa acheronta, Fabr. (*cadmus*, Cram.). A broken fore-wing of this species was picked up off the ground in a wood above Constant Spring, January 5th, 1907.

The Haïti specimens in the Hope Collection are more fulvous than those from the mainland, and this fragment appears to be of Haïtian type.

LYCÆNIDÆ.

Leptotes (*Tarucus*) *theonus*, Lefebre, 1856 (*Plebeius cassius*, var. a, *floridensis*, Morrison, 1874), 8 ♂, 19 ♀. Met with in every locality that I visited: common at Mackfield; abundant at Constant Spring, Gordon Town and Port Antonio. The excess of females taken may be attributed to its superior size and attractiveness, but possibly it is easier to capture. It is most often seen flying over shrubs or near woods; it has a quick jerky flight and appears larger than it is, especially the female. After rain it is about the first butterfly to come out.

All my specimens taken in Jamaica are distinguishable at a glance from those taken in South America, Trinidad or Tobago. They are smaller and darker; the hind-wing of the male is violet-blue instead of white; the fore-wing of the female is shot with blue over at least two-thirds of the fore-wing, and there is much less white in the hind-wing. On the underside the metallic-centred ocellus is larger, and there are differences in the dark markings of the fore-wing.

In my opinion it is specifically distinct from *S. cassius*, Cram., but if not distinct it is a very well-marked local race. The earliest description of the form that I can find is that by Lefebre in Ramon de la Sagra's "Histor. Cuba," VII, p. 611, and it should, I think, bear his name. It appears in W. Holland's "Butterfly Book" as *Lycæna theonus*, Lucas.

Catochrysops hanno, Stoll (? *monops*, Zeller). 11 specimens. Abundant at Constant Spring, also met with at Mackfield, Walderston and Port Antonio. Its small size and insignificant appearance probably often cause it to be passed over. It frequents small Composites by the roadside, especially *Distreptus spicatus*, Cass.

Callipsyche thius, Hübn. A single very fine male near the Jam Factory, at the foot of the hills, Constant Spring. On the wing I took it for a Skipper. This and the specimens from Jamaica in the National Collection lack the white mark at the tip of the fore-wing of the male met with in Venezuelan examples.

Calycopis pan, Drury. Three specimens, taken in the garden at Walderston by my Portuguese servant. The lobes of the hind-wings are everted as in the Indian *Aphnæus* and the South African *Argiolaus*.

PIERINÆ.

Callidryas eubule, Linn. (f. *sennæ*, Linn.). 17 ♂, 14 ♀. Constant Spring (common), Gordon Town (abundant), Castleton, Temple Hall (abundant), Mandeville, Mackfield (common), Montego Bay (common), Walderston, Christiana, Spanish Town (abundant), Port Antonio (abundant).

If not actually the most abundant, at all events the most conspicuous butterfly on the island. Brilliant in colour, bold in flight, and numerous in individuals, it was always much in evidence.

The "dry" form prevailed, more especially as the season advanced.

Kricogonia lyside, Godt., 6 ♂, 2 ♀. Ramble, Montego Bay, Spanish Town, Port Antonio (not uncommon along the coast to the eastward).

Glutophrissa ? drusilla, Cram. Common at Constant Spring, also taken at Montego Bay. This species usually flies high, frequenting flowering trees and so out of reach. My specimens are small, especially the females, which are quite devoid of black markings. Somewhat similar

specimens from Jamaica and other islands were named by Mr. Butler *ilaire*, Godt., but the type of Godart's insect came from Brazil. In the museum at Kingston this bears the name *Appias poeyi*, Butl. It is perhaps the *Mylothris margarita* of Hübner. It would be interesting to see Jamaican specimens taken in the wet season, for the presumption is that mine are of the dry form.

Sphænogona adamsi, Lathy. Of this butterfly, so rare in collections, I was fortunate enough to secure a male and three females. One of the latter was taken near Constant Spring, the other three specimens on the Manchester Mountains, viz. one at Contrivance, about 2700 feet, the other two on Mile Gully Mountain at nearly the same elevation.

The solitary specimen in the National Collection is from "Kingston, Jamaica."

Terias euterpe, Ménét, 39 ♂, 21 ♀. The commonest species of the genus in Jamaica. Constant Spring (abundant), Gordon Town (not common), Castleton, Mandeville, Ramble (abundant), Montego Bay, Walderston (not common), Port Antonio (common).

As this little butterfly flits along close to the ground it appears to be easy to catch; however, it goes faster than one would think; its flight is jerky, and when struck at it almost always goes down into the herbage and so escapes the net again and again. This remark must be held to apply to several species of *Terias*, which were not always distinguished in the field.

A male was taken at Mackfield with a small symmetrical injury to each hind-wing.

Terias westwoodii, Boisd. (The Jamaican form, ? *dina*, Poey.) Three males, two females. Only met with at Montego Bay. It flies more freely and more strongly than the last.

The Jamaican specimens are small and pale: the black on the hind-margin (especially in the female) is limited to the tip of the fore-wing.

Terias messalina, Fabr., 10 ♂, 10 ♀. Constant Spring, Hotel Grounds and wood to N.E., Mackfield (common), Montego Bay, Spanish Town, Port Antonio.

Terias delia, Cram., 16 ♂, 14 ♀. Widely distributed, but not so common as *euterpe*. Constant Spring (common), Castleton, Mandeville, Mackfield, Montego Bay, Walderston, Port Antonio.

A male taken above Constant Spring at about 1000 feet elevation on January 1st; another male taken near Chancery Hall, 500 feet, on January 8th, approached the form *lydia*, Feld., in having the longitudinal black streak broader than usual. On the other hand, another male taken somewhat below the first named and on the same day has *no black streak* at all, merely the streak of orange.

Terias elathea, Cram., 3 ♂, 1 ♀. Scarce. Constant Spring, Montego Bay, Port Antonio (Shotover Hill).

This butterfly appears to be specifically distinct from *delia*, Cram., but is certainly very closely allied to it. The females are difficult to distinguish, and some specimens of the male sex not easy. In two males from Venezuela one has the black streak obsolescent, in the other entirely absent with indeed very little orange.

Pieris phileta, Fabr. (*monuste*, Hübn. et auct. *nec* Linn.), 4 ♂, 1 ♀. Only met with at Montego Bay, and at Contrivance, Walderston.

The flight of this butterfly is sometimes extremely swift, and it exercised my active Portuguese servant and myself very severely to secure three specimens near the shore of Montego Bay. Sometimes it may be taken at the flowers of *Eupatorium odoratum*, Linn. During life the clubs of the antennæ are of a beautiful turquoise blue.

PAPILIONINÆ.

Papilio polydamas, Linn. (f. *polycrates*, Hopff.). 7 specimens. Constant Spring (common), below Gordon Town, Spanish Town. Not seen on the high land.

Fond of flowers, especially *Bougainvillea*, fluttering as it feeds, as many of the family do. A specimen observed flying in deep shade about 5 p.m. settled on a dead leaf and closed its wings; the underside was distinctly cryptic.

All my specimens are of the insular form in which the marginal spots of the fore-wing are paler, those of the hind-wing greener, than in South American examples: the marginal pattern on the underside of the hind-wing is coarser, with more brick-red and more white in it.

HESPERIIDÆ.

Eudamus proteus, Linn. 9 specimens. Constant Spring, below Gordon Town, Port António (common). Has a quiet flapping flight; at rest all its wings are nearly upright, but the fore-wings much sloped back, the *tails at*

right angles to the plane of the hind-wings. Frequents *Bougainvillæa* flowers.

Eudamas catillus, Cram. Two specimens, taken late in the afternoon in a wood at Montego Bay; flight not very swift.

Thymele grenadensis, Schaus. A very worn specimen, on the bank of the Rio Cobre, Spanish Town. It settled repeatedly on the same spot.

Telegonus hurga, Schaus. A worn specimen, in the Mahogany Wood, Rockalva, Ramble. It was very bold, returning again and again to rest on the same fallen tree.

Perichares corydon, Fabr. Two. Mackfield, Montego Bay.

Prenes nyctelius, Latr. Three. Mandeville, Port Antonio ("Shotover," East Harbour).

Prenes ares, Feld. One. "Shotover," Port Antonio.

Anastrus simplicior, Möschl. One. Cold Harbour, Port Antonio. Rests with the wings fully expanded.

Acolastes amyntas, Linn. One, taken by Mrs. Longstaff in the Botanic Garden, Castleton.

Serdis aurinia, Plötz. One of each sex, taken at the foot of Park Mount, Port Antonio, about 2.30 p.m. A very distinct insect identified by Mr. H. H. Druce with Plötz' excellent figure of the male from a Jamaican specimen. The insect does not seem to be known in British collections. Mr. Godman ("Ann. Mag. Nat. Hist.," Aug. 1907) says of the figure that it probably belongs to *Limochares* or *Serdis*. Mabille places it in his genus *Serdis* under the heading "Species non visæ" (*Genera Insectorum*, Hesperidæ, p. 144).*

Ephyriades otreus, Cram. One specimen, near Chancery Hall, Constant Spring; settled on a projecting grass stem with wings fully expanded.

Hesperia syrichthus, Fabr. Twelve. Generally distributed over the Island, especially common at Mandeville and Port Antonio. A somewhat variable species within limits. It rests with the wings fully expanded.

Hylephila phylæus, Drury. Five. This brilliant little

* On April 5, 1908, Mr. H. H. Druce wrote saying that among some oddments in the British Museum he had come across the type of Butler's *Pamphila insolata*. (See Proc. Zool. Soc. Lond., 1878, p. 483.) The specimen is from Jamaica (labelled *insolita*), and appears to be identical with my insects. Butler's name has priority since Plötz published his description in 1883.

golden Skipper was common near the shore, Port Antonio.

Catia drurii, Latr. Two. Below Gordon Town, c. 800 feet, and on the Park Mount Road, Port Antonio, c. 600 feet. Very hard to see. It rests with all the wings up, the fore-wings much sloped back.

Catia vesuria, Plötz. One, taken by my Portuguese servant in the garden at Walderston.

Morys valerius, Möschl. Four. Two above Constant Spring, c. 700 feet; two on "Shotover," Port Antonio.

Thymelicus vibex, Hübn. (The yellowest form is *combinata*, Plötz., H. H. Druce.) A female *came to light* at Montego Bay.

Cymænes silius, Latr. One, in the wood above the Jam Factory, Constant Spring.

I call attention to the number of species in which Jamaican examples differ from Venezuelan in the replacement of black or grey by fulvous, or orange brown. It is true that the soil of Jamaica, even where the formation is white coralline limestone, is often of an orange brown colour, but it scarcely seems possible to connect the two as cause and effect.

III. *On some of the* Butterflies *of* Tobago. By G. B. Longstaff, M.D., F.R.C.P., F.E.S.

[Read November 6, 1907.]

A glance at the map shows that this island stands outside the crescent of the Lesser Antilles, or Windward Islands, about 20 miles to the north-east of Trinidad in latitude 11° 15′ N. The southernmost of the Windward Islands proper, Grenada, is about 70 miles W.N.W. of Tobago. It is therefore pretty obvious that, geographically speaking, Tobago belongs to South America rather than to the West Indies. The mountains of the north-east coast of Venezuela, consisting for the most part of clay-slates and schists believed to be of Silurian age, run by way of the peninsula of Paria and the islets of the Bocas, along the northern coast of Trinidad, and would appear to be prolonged to the eastern half of Tobago.

In area Tobago is about equal to the county of London, comprising but 114 square miles, and therefore only about three-fourths of the size of the Isle of Wight, and only one-fifteenth of that of its neighbour. (Trinidad area, 1754 square miles = Lancashire.) The south-western portion of the island, which is low and more or less flat, is formed of coralline limestone, and is completely cultivated. The central and north-eastern portions are hilly, rising to 2000 feet, and in large part covered with forest, some of it virgin, but much of it of second growth, or "rastrajo." The destruction of the forest is proceeding apace.

My stay was limited to eight days, April 3–10, 1907, of which, thanks to the hospitality of the Hon. H. L. Thornton and Mr. G. H. Sworder, three were spent at their estate, "Cocoa Wattie," the remainder near the coast.

We found the neighbourhood of Scarborough, the capital, for some miles on either side of the town very dry and parched, though we were told that there had been "some nice showers at night" during March. The Trade-wind blows very strongly along the coast, a dry, hot wind which greatly increases the difficulties of the collector.

Cocoa Wattie is a plantation near the middle of the

island towards the confines of cultivation, lying about 550 feet above sea-level. The wooded banks of a small river and some swampy hollows clothed with coarse grass and thin scrub afforded the best collecting grounds, and yielded, as might have been expected, a somewhat different fauna from that of the coast. It rained heavily on April 8th.

Anosia archippus, Fabr. 3 ♂, 1 ♀. Rather common in the outskirts of Scarborough; one specimen at Cocoa Wattie. Those taken resemble the specimens from the mainland, though one individual, a ♂, approached Jamaican specimens in colouring.

Euptychia hermes, Fabr. (*camerta*, Cram.). 5. Abundant at Cocoa Wattie.

Euptychia hesione, Sulz. 6. Common at Cocoa Wattie. I have taken this species and the following flying during rain.

Heliconius hydara, Hew. 3 ♂, 2 ♀. Rather common on the river bank at Cocoa Wattie. All the specimens are small, three extremely small; four of them have the bluish gloss (as in the form *guarica*, Reak., though that is a larger insect) which Mr. W. J. Kaye associates with wet conditions.

Precis lavinia, Cram. (f. *zonalis*, Feld.). 2 ♂. An example taken near the coast of the dry form, but with the anterior ocellus on the hind-wing very small. (Mr. W. J. Kaye has two very dark specimens from Mexico in which this ocellus is altogether wanting; in the National Collection there is a specimen from Colombia in which there are *no ocelli* on the upper surface, and only faint indications of them beneath.) The Cocoa Wattie example is "intermediate," approaching the "wet" form. Both the specimens would probably be called by Mr. Godman *cœnia*, Hübn., and by West Indian entomologists *genoveva*, Cram.; I follow Mr. Guy A. K. Marshall's recent rearrangement of the splendid series at South Kensington.

Anartia jatrophæ, Linn. 3. On the coast, not common. Those taken are pale in colour and semi-transparent, of the mainland form.

Anartia amalthea, Linn. One at Cocoa Wattie. Messrs. Godman and Salvin * say of this species: "Barbados, a

* Godman and Salvin, "Butterflies of St. Vincent, Grenada, etc.," Proc. Zool. Soc. London, 1896, p. 515.

single specimen . . . not previously noted from any West Indian island."

Dynamine theseus, Feld. This pretty little butterfly was common both on the coast and inland. It has a rapid gliding flight, but otherwise has some of the habits of a Lycænid, thus it often settles with its head downwards, and more than once I saw it move its hind-wings rapidly immediately after settling; the insect was, however, too shy to enable me to make out the exact nature of this movement.

Cystineura cana, Erichs. Two specimens on the coast, and two at Cocoa Wattie. It has a gliding flight.

Leptotes (*Tarucus*) *cassius*, Cram. 2 ♂, 2 ♀. Of the mainland form, in which white prevails over blue. Rather common along the coast; three specimens were small, but one female was larger than usual.

Catochrysops hanno, Stoll. (? *monops*, Zell.). One specimen to the east of Scarborough.

Thecla beon, Cram. 4. One specimen on the shore to the south-west of the town at the flowers of the Sea-side Grape (*Coccoloba uvifera*, Jacq.); rather common at Cocoa Wattie, frequenting the flowers of a purple papilionaceous shrub.

Thecla politus, H. H. Druce. A ♀ at Cocoa Wattie.

Thecla nubes, H. H. Druce, n. sp. One specimen at the Sea-side Grape, near Hillsborough; four at Cocoa Wattie at the pink flowers of a creeper.*

Callicista bubastus, Cram. (*salona*, Hübn.). One taken in Fort George, another at the flowers of the Sea-side Grape, near Hillsborough on the coast.

Terias nise, Cram., 3 ♂, 3 ♀, all of the "wet-season" form. Common near the coast.

Terias albula, Cram. 3. Near the coast, less common than the last; one taken two miles inland on the road to Cocoa Wattie.

Pieris phileta, Fabr. (*monuste*, Auct. *nec* Linn.). Two males under the coco-nut palms to the west of the town.

Callidryas eubule, Linn. (f. *sennæ*, Linn.). Abundant in Scarborough and along the coast towards the east, tearing about in all directions, but not at all common at Cocoa Wattie. Six ♂ and four ♀ taken, of these three were of the "wet-season" form, seven "intermediate," but all were

* H. H. Druce, Proc. Zool. Soc. Lond., 1907, p. 625.

very small. I noted that the males were attracted in numbers by the flowers of the Pineapple (*Ananassa sativa*, Lindl.) in the Government Botanic Station.

Phœbis agarithe, Boisd. 3 ♂, 1 ♀. Common to the east of Scarborough; very showy on the wing, though very difficult to catch, being not merely a strong flier, but also wary and seldom remaining on a flower for more than a few seconds, moreover it seems to like exposed places in the full blast of the Trade-wind. Those taken were all small, one male remarkably so; they are moreover much paler than specimens in the Hope Collection from Barbados and Venezuela.

Eudamus catillus, Cram. One small specimen on the shore to the west of the town.

Pyrrhopyge venezuelæ, Scudder. One at Cocoa Wattie.

Hesperia syrichthus, Fabr. Common on the coast; one example at Cocoa Wattie.

Callimormus corades, Feld. Three at Cocoa Wattie.

Systacea erosa, Hübn. One at Cocoa Wattie. In this species the fore-wings are remarkably convex.

Epeus veleda, Godm. and S. One at Cocoa Wattie.

Megistias cortica, Plötz. (*epiberus*, Mabille.). One at Cocoa Wattie.

Cymænes silius, Latr. One at Cocoa Wattie. This species rests with the wings in the same position as our *Pamphila thaumas* and *P. sylvanus*.

Of the 28 species in this list, 24 * are known to Mr. Kaye as occurring in Trinidad; those not met with in both islands being *Phœbis agarithe*, *Thecla nubes*, *Epeus veleda* and *Callimormus corades*. None of these is recorded by Messrs. Godman and Salvin from the Lesser Antilles.

As regards the general abundance of Butterflies, Tobago occupies a position between Jamaica and Trinidad. Whereas eight days' collecting in Tobago yielded 28 species, seven days' in Trinidad yielded 61; but it took ten weeks to get together 47 species in Jamaica. On the other hand, Venezuela proved much richer than any of these islands, for 135 species were collected in fifteen days.

In addition to the above I saw on the wing, about a mile from Cocoa Wattie, *Caligo* sp.; also Mr. Sworder gave me specimens of *Ithomia pellucida*, Hopff., and *Pteronymia asopo*, Feld., which he had taken at Cocoa Wattie, and he showed me specimens of other butterflies which I did not

* Of these 24 at least 19 also occur in Venezuela.

happen upon alive, including *Morpho* sp. The Hope Collection has *Terias westwoodii*, Boisd., from Tobago. Neither this last named nor *P. asopo* have as yet been recorded from Trinidad.

My cordial thanks are due to Prof. E. B. Poulton, F.R.S., and the assistants of the Hope Department, Oxford; to Mr. F. A. Heron and Mr. W. J. Kaye; and more especially to Dr. F. A. Dixey for naming the Pierines, and Mr. H. H. Druce for naming the Lycænids and Hesperids, and for describing a new species.

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A FORTNIGHT'S WINTER COLLECTING IN VENEZUELA.

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On December 20th, 1906, the R.M.S. "Tagus," bound to Jamaica, touched at La Guaira, a place that Charles Kingsley has immortalized in his great romance. Owing to the formalities of the Venezuelan officials we could not land till the afternoon was far advanced. The "Aden of the Caribbean Sea" proved less hot than we had been led to expect, for a mantle of heavy clouds came far down the mountains that almost seem to overhang the town. A push was made to the most promising spur, a little to the west, where a fair number of butterflies were seen, though few were taken. The extremely steep slopes appeared to consist of bright red clay scantily clothed with small bushes, amongst which a species of *Cistus* predominated. Pursuit was almost out of the question, and one's operations were not facilitated by the well-meant attentions of some small Indian boys.

On examination at home my captures proved to be *Ithomia iphianassa*, Dbl. and Hew.; *Ageronia ferentina*, Godt., and *Tmolus cambes*, Godm. and S., one of each. Of the last named Mr. H. H. Druce informs me that the type came from Mexico, and that it has not previously been recorded south of Guatemala. There were also a worn specimen of *Sphænogona gratiosa*, Dbl. and H., two of *Terias albula*, Cram. (one of them having the black border of the hind-wing unusually pronounced), and two of the Skipper, *Heliopetes laviana*, Hew. With these Butterflies were a very few insects of other Orders.

I landed on the Venezuelan shore for the second time March 17th, 1907, but on this occasion the whole afternoon was spent in struggling with the authorities of the port, so that it was necessary to spend a night at La Guaira. The next day a halt at Zigzag Station, about 1500 ft. up the railway to the Capital, enabled me to sample the insect fauna. Butterflies were very plentiful, and I ran back to the railway carriage with specimens of *Actinote antæas*, Dbl. and H.; *Euptychia phares*, Godt., a species that I did not see again; *Phyciodes leucodesma*, Feld.; *Terias albula*, Cram., and *Hesperia syrichthus*, Fabr., together with sundry wasps, bugs, and grasshoppers.

The railway after many terror-inspiring twists gains access to the capital by a gap in the mountains on its western side.

CARÁCAS stands at a mean altitude of 3200 ft. above the sea in North Lat. 10° 30′. The city is beautifully situated on a plateau sloping southwards to the Rio Guaire; this plateau is open to the East towards Petare, closed to the West by the Observatory Hill some three hundred feet above the plain; on the South it is bounded

by two low ridges that separate Carácas from El Valle, but on the North it is dominated by a lofty range of mountains, which rising abruptly from the valley culminate to the North West in Silla, 8760 ft., and Naiguata, 9300 ft.

The Observatory commands a grand prospect, but the path leading to it was far from productive, yielding only *Phyciodes anieta*, Hew.; *Synchloë lacinia*, Hübn., the dark form; *Leptotes* (*Tarucus*) *cassius*, Cram., both sexes; *Terias elathea*, Cram., a male, an aberration of the "moderately dry" form in which there was no trace of the usually conspicuous longitudinal black streak, and scarcely any of the orange border thereto; also *Hesperia notata*, Blanch., the only example met with.

The village of El Valle stands at about the same level as Carácas, some four miles to the south, and as it is conveniently placed at the terminus of a tramway I visited it three times, but my first visit was spoilt by heavy rain A bluff on the outskirts of the village displayed sufficient flowers to attract a fair number of insects, the best of which was the large Skipper, *Prenes evadnes*, Cram., the only one that I met with, but a lane leading from the village southwards to a ford proved a better collecting ground. This lane, bounded on either side by a wet ditch and a flowery hedge, had an English look that was delightfully refreshing. Here were a number of the commoner Butterflies, conspicuous among them the "Brimstone," *Callidryas eubule*, Linn. (f. *sennæ*, L.), of both sexes; *Anosia archippus*, Fabr.; *Actinote antæas*, Dbl. and H.; the beautiful yellow and black *Heliconius charithonia*, Linn.; the brilliant red, black and white *Anartia amalthea*, Linn., flying as usual close to the water, but unfortunately in poor condition; the dingy Satyrine, *Euptychia hermes*, Fabr. (*camerta*, Cram.), together with its more attractive white-striped congener, *E. hesione*, Sulz.; there were also several males of the "Common White" of those parts, *Leptophobia aripa*, Boisd., and a male of the common *Terias albula*, Cram., a white member of a yellow genus. But besides these familiar forms there were several of greater interest, at all events to one new to South America. The small Nymphalines, *Phyciodes lelex*, Bates, and *P. liriope*, Cram.; a female of *Terias nise*, Cram.; two male *Sphænogona arbela*, Hübn., of an unusually pale form; a female of the fine *Daptonoura lycimnia*, Cram.; a specimen of the large Ithomiine, *Mechanitis veritabilis*, Butl.; the black and white Lycænid, *Polyniphe dumenilii*, Godt., and the Skipper, *Chiomara gesta*, H.-S. But there were in addition several Butterflies in that narrow lane which I did

not meet with elsewhere in Venezuela, conspicuous among them, on the flowers of *Lantana camera*, Linn, was a specimen of the long-winged, richly silver-plated *Dione juno*, Cram., strikingly resembling *Colænis julia*, Fabr., as regards its upper surface, but with an underside that at once recalled the European *Argynnis lathonia*, Linn.; even more attractive was the essentially Neo-tropical Nymphaline, *Myscelia cyaniris*, Hew., grey with white stripes, shot with brilliant violet—conspicuous as this looks in the cabinet it is by no means as conspicuous when sitting, as it is fond of doing, on light grey bark; a black, white, and red Butterfly seen fluttering at the bottom of a ditch turned out to be a male of the truly exquisite *Papilio eurimedes*, Cram., perfect in shape and finish, and with a marvellous blue gleam in certain lights; less striking than the last was an unusually small female of its soberly coloured congener, *P. polydamas*, Linn.; lastly, there were two Skippers peculiar to that lane, viz.:—*Xenophanes tristis*, Boisd., and *Paches geometrinus*, Feld., both well meriting the specific name of the latter.

I tried another and very different collecting ground at El Valle—a combe on the southern side of the ridge lying immediately to the north of the village. A narrow path led through low scrub up to the crest, perhaps some 500 feet above the river. Most of my collecting was, however, a couple of hundred feet or so lower. A short distance up, near a lime kiln, several *Heliconius charithonia*, Linn., were seen, and close by the small black and white Lycænid, *Polyniphe dumenilii*, Godt., was to be had in abundance; it is strange, but true, that this very small Butterfly is the proud possessor of one of the strongest scents (?)—very suggestive of pigstyes, or at any rate of pigs! Several other Lycænids were taken in this combe: *Leptotes cassius*, Cram., a male; *Catochrysops hanno*, Stoll., two males; *Thecla rufofusca*, Hew., two; *Callipsyche thius*, Hübn.,* six; but the most interesting Lycænid was a single rather sorry individual, of which Mr. H. H. Druce writes: "This is an interesting specimen. I cannot distinguish it from the well-known Eastern and African *Zizera gaika*, Trimen (*pygmæa*, Snell.), which has a wide range, India, Ceylon, Malay, Australia, South Africa (Rhodesia), &c., but I have never seen it from America, and do not know that it has been recorded. Can it have been recently introduced?" This insect was certainly taken at El Valle, March 26th, 1907, but unfortunately my record leaves it in doubt whether it was taken near the river or up the combe.

The only Satyrines found were a few *Euptychia hermes*, Fabr.

* Mr. H. H. Druce says this is the same as *Thecla agra*, Hew.; my males from Venezuela have a white tip to the fore-wing, which is not present in Jamaica specimens.

(*camerta*, Cram.), but the Nymphalines were as usual well represented, conspicuous amongst them was the bright little *Cybdelis mnasylus*, Dbl. and H., looking for all the world like a miniature *Hypolimnas misippus*, Linn.; this is the only place that I came across it, but here it was quite common, fluttering about low plants, and never settling for long. *Phyciodes* was represented by one *anieta*, Hew., and *Dynamine* by *postverta*, Cram., *theseus*, Feld., and *sara*, Bates; one of the last named was drinking at mud. A fine *Hypna clytemnestra*, Cram., caused me much tribulation; I saw it on both my visits to the combe, missing it three times, then, as I was returning to its haunt full of good resolutions to keep cool and so ensure success, a wretched boy brought it to me in triumph, having caught it with his hat! It *had been* a good specimen of the very distinct form *rufescens*, Butl. The Vanessa-like *Anæa ryphea*, Cram., was rather commoner, and I secured four; one of these was captured on the very windy crest of the ridge together with *Tasitia eresimus*, Cram., a female; *Synchloë lacinia*, Hübn., f. *saundersii*, Dbl. and H., and two males of the common *Precis lavinia*, Cram., of the dry form corresponding to *zonalis*, Feld., but more dingy than Jamaican specimens. This is the *P. michaelisi* of Fruhstorfer (Stett. Entom Zeit., 1907, p. 224).

My delight was great at taking *Callicore marchalii*, Guér., a butterfly more interesting to Venezuelan politicians from its bearing the mystic figures "88" upon the under-side of its hind-wings, than for its singular beauty. I also took here my first *Didonis biblis*, Fabr., a handsome black and scarlet butterfly that I was soon to become familiar with in Trinidad; it returns again and again to the same place, as do our *Vanessæ*.

Pierines were not common up that combe. Of *Meganostoma cerbera*, Feld., I took a female; of *Sphænogona gratiosa*, Dbl. and H., a male, and of *S. arbela*, Hübn., three males of an unusual pale form. The very familiar *Callidryas eubule*, Linn., was represented by a small, somewhat "dry" male. I captured one of each sex of *Pseudopieris nehemia*, Boisd. That hillside did not produce a single *Papilio*.

Skippers, as is often the case in the New World, were more remarkable for the number of species than of individuals; those met with were:—*Heliopetes alana*, Reakt. (*adusta*, Ploetz), one; *H. arsalte*, Linn., one, this has a swift, dashing flight; the large long-tailed *Eudamus catillus*, Cram., one; *E. eurycles*, Latr., one; *Arteurotia tractipennis*, Butl. and Druce, one; the pretty *Larentia*-like *Chiomara asychis*, Cram., one; one of an unnamed small black species, and one of the very widely distributed *Hesperia syrichthus*, Fabr.

An attempt to reach the primæval forest high on the mountains to the north of Carácas was a disastrous failure. We climbed on horseback up the once fine road to La Guaira; its cobble paving is fast disappearing, and the road itself much cut away by impetuous water-courses now left free to work their wild will, since the railway built by English engineers has given the Venezuelans an excuse for not repairing the old Royal Road. We went up and up, but no signs of forest appeared. Meanwhile threatening clouds came down the mountain, as if to meet us; the guide took us a turning towards the West and proudly showed, what he thought much better than any forest—a somewhat miserable nursery garden! We lunched in gloom at about 5000 feet, and then the rain began. There was nothing for it but to hurry down again, and we reached Carácas to find the streets in the suburbs rushing rivers and ourselves like drowned rats. Bag:—*Phyciodes anieta*, Hew., one; *Euptychia pharella*, Butl., one; *E. hermes*, Fabr., one; *Terias phiale*, Cram., a male; *Sphænogona arbela*, Hübn., a female of the usual yellow form, and five specimens of the elegant *Oressinoma typhla*, Dbl. and H., a delicate Satyrid with a broad white stripe across both wings, which often flies when the sun is not shining.

When climbing up the old La Guaira road I had noticed a wooded gorge far below on my right hand and took an early opportunity to investigate it. It proved to be a waterworks conservation and was partly enclosed. The collecting ground may be said to be from 3500 to 3700 ft. above sea-level. The shaded path was just the place for Satyrines, which were fairly numerous, being represented by *Euptychia saturnus*, Butl., three, a species that I did not find elsewhere; *E. hermes*, Fabr. (*camerta*, Cram.), five; *E. pharella*, Butl., three; and *Oressinoma typhla*, Dbl. and H., three, one of them very small.

Nymphalines were quite unusually scarce, the only species captured were *Phyciodes lelex*, Bates, and *P. anieta*, Hew. The sole Lycænid was *Polyniphe dumenilii*, Godt. No *Papilio* was taken.

Of the Pierines, those taken were *Pseudopieris nehemia*, Boisd., six males and a female; *Sphænogona arbela*, Hübn., a male of the usual yellow form; also three males of *Terias phiale*, Cram., one of them an aberration having more black than usual on the hind-wing and but little yellow.

Heliconius was poorly represented by a single *charithonia*, Linn., but the Ithomiines were more numerous, and included *Ithomia*

andromica, Hew., two; *Aëria eurymedia*, Cram., one; *Hypoleria ocalea*, Dbl. and H., one; and *Athesis clearista*, Dbl., a female.

Actinote antæas, Dbl. and H., was of course present, and there were a few Skippers, to wit, *Hesperia syrichthus*, Linn., one; *Eudamas eurycles*, Latr., one; *Hesperia uniformis*, Ploetz, one; and a worn insect that is probably *Chiomara gesta*, H.-S.

I also secured a specimen of the pretty orange, black-bordered, day-flying Geometer, *Devarodes hypocritaria*, Guén.

But I reserve to the last my favourite hunting ground at Carácas, which I visited altogether four times during my short stay. A few minutes' walk beyond the Puente 9 de Febrero brings one to the closed Cementerio Hijos de Dios, to the right of which the path crosses a deep "barranco" where there are usually a number of *Actinote anteas*, Dbl. and H.: this is an unmistakeable Acræine; it has a slow flight and when at rest the fore-wings are always drawn back completely within the hind-wings, so as to give the insect a very long, drawn-out look. It is tenacious of life, but I did not detect any scent.

Beyond the barranco the path leads across a field past a cottage and round the head of another smaller barranco—where the effects of denudation with fairly well-formed "earth-pillars" may be studied —it then strikes a small water-course* cut along the mountain side. The path may be followed eastwards, beside the channel, along the contour at a height of about 3600 feet above the sea. A more delightful walk can scarcely be imagined with the city at one's feet, yet for all practical purposes miles away, since the numerous barrancos keep all but a few farmers well out of reach. There are plenty of flowers along the water-course and plenty of insects. About a mile brings one to the source, a small mountain torrent rising in the cloud regions far above, but compelled by the patient farmers to water their lands below. It is easy to scramble down the bed of the stream, but I found it better to take a path to the right leading through a picturesque farmyard, below which another water-course is reached, about 120 feet lower down the mountain. Here *Leptophobia aripa*, Boisd., was usually in abundance, together with the beautiful day-flying Arctiid, *Utetheisa (Deiopeia) ornatrix*, Linn. Turning again to the left along the channel the source was soon reached. A strip of forest on either bank hides the torrent from view, presumably to preserve the water. Here was all that a tropical Collector could desire —trees, flowers, shelter from wind, sunshine (in the forenoon), and

* This is just what a Madeiran Portuguese would call a *levada*; I have had much difficulty in learning the Spanish equivalent, perhaps *toma* or *acueducto*.

above all moisture. It was a little before 4 p.m. on the rather dull afternoon of March 20th, 1907, that I first scrambled up this gully. I had met with a few Ithomiines previously, but only odd ones, here and there; now it was my pleasure to see what I had read of.

Bates, in his classical paper on the *Heliconiidæ*, writing of the genus *Ithomia*, says:—"They are prolific insects, and gregarious in their habits, flocks of many different species associating together. Their flight is low and weak; and they affect only certain parts of the forest, generally shady hollows, where many hundreds may often be seen sporting together, though not an individual is found in any other part of the neighbourhood."—*Trans. Linn. Soc.*, vol. xxiii, p. 539.

Again:—"The flocks of Butterflies, all of the same colour, and undistinguishable from one another when on the wing, which fly together in the same dry hollows of the forest. . . ." *Ibid.*, p. 541.

Alongside the right bank of the mountain stream was a comparatively level strip of ground, some six or eight yards wide, damp, and in places swampy, covered for the most part with the "Life-plant" (*Bryophyllum calycinum*, Salisb.). The place was overshadowed by what appeared to be a species of "Coral-tree," or "Bois immortel," as it is called in Trinidad (*Erythrina* sp.), and there was an undergrowth of Wild Coffee and a few Bamboos. As I pushed along, my movements suddenly disturbed a number of butterflies, which fluttered about in clouds, looking with their transparent wings almost like *Tipulæ*, only more ghost-like. Sometimes their wings would catch the light with an iridescent gleam, but more usually little could be seen save the opaque white marks upon their wings. Of course the more thickly scaled forms were more conspicuous, but as a rule all the black portions of the insects were invisible. It was a wonderful sight, but quite bewildering. Two or three sweeps of the net entrapped a dozen or so. I only took back that afternoon thirty-five specimens, which I imagined included three or four, possibly five or six species. In truth, there were eleven species belonging to eight genera.

A visit to the same spot the next day produced a similar result, the hour was earlier and the Ithomiines were not so closely packed, yet I took home thirty specimens, which proved to belong to nine species, three of which I had not taken on the first day. A third visit failed to add further to the list which stands as follows:—

Athesis clearista, Dbl. and H.	3	
Ceratinia cœno, Dbl. and H.	17	(abundant).
Ceratinia dionæa, Hew.	2	
Pteronymia latilla, Hew.	16	(very common).
Pteronymia asopo, Feld.	3	
Pteronymia victorina, Hew.	2	
Ithomia agnosia, Hew.	6	
Ithomia cymothoë, Klug	8	
Ithomia iphianassa, Dbl. and H.	6	
Ithomia sylvella, Hew.	1	
Hymenitis andromica, Hew.	19	(abundant).
Leucothyris phemonoë, Dbl.	3	
Hypoleria ocalea, Dbl. and H.	1	
Aëria agna, Godm. and S.	1	

A total of eighty-eight specimens, belonging to fourteen species divided amongst eight genera of one group of butterflies, is a sufficiently remarkable record for three visits to a strip of ground which certainly did not exceed 50 yards in length by 10 yards in width. While fully bearing out Bates' account, it forms a striking exception to Darwin's rule that nearly allied species are seldom found in close competition on the same ground.

On another occasion I met with a similar experience. On March 28th, 1907, a hot sunny morning, as I was walking along the upper water course where it runs through the wood almost clinging to the face of the cliff (perhaps a quarter of a mile from the previously described locality), passing under the shade of a large tree I disturbed a crowd of butterflies so dense that fourteen were easily netted in two or three swoops. Ten of these were pinched, which all proved to be *Ithomia sylvella*, Hew., four of them got away. In this instance the butterflies were confined to some four or five yards of the narrow path, and it was almost a " pure culture " of that singularly delicate little species, indeed, the only exceptions were two specimens of *Athesis clearista*, Dbl., and single specimens of *Pteronymia latilla*, Hew., and *Dircenna jemima*, Hübn. I may add that I have no reason in either case to think that the Ithomiines were drinking at the stream.

But besides Ithomiines there were plenty of other butterflies along the banks of that stream and the water-courses leading from it. To begin with the less exciting Satyrines. There were *Euptychia hermes*, Fabr. (*camerta*, Cram.), and the smaller *E. pharella*, Butl., the

latter very common among grass and less chary of sunlight than many of the family; the more attractive *Oressinoma typhla*, Dbl. and H., was on the contrary always found in the shade.

The commonest Nymphaline was the tiny fulvous *Phyciodes anieta*, Hew. Here also I first made acquaintance with the beautiful genus *Dynamine*, capturing three *theseus*, Feld., and one *geta*, Godm. *Anartia amalthea*, Linn., flew over the water of the levadas, and *Precis lavinia*, Cram., was as usual easier to see than to catch. A single specimen of *Pyrameis myrinna*, Dbl., was captured at the flowers of a Composite creeper near the farmhouse, while the shades of the wood yielded the larger game *Victorina stelenes*, Linn., and *Amphirene epaphus*, Latr.; one of the last named was drinking in the bed of the stream, where I had the bad luck to miss a *Callicore*. But of all the beautiful butterflies seen there by far the most startling was my first *Morpho*. A huge bird-like creature sailing down the gully, now giving an azure flash, now almost disappearing as the upper surface turns away—flash, flash, flash, and it is out of sight! Shortly afterwards I had the pleasure of beating *Morpho peleides*, Koll., a male, out of a bush and netting it as it flapped away.

The sole Danaine was a male, *Anosia archippus*, Fabr., but the Acræines were represented by a number of *Actinote anteas*, Dbl. and H., though that species was commoner in the outskirts of the city; of its congener *A. hylonome*, Dbl., I only secured a single specimen. The only Erycinids taken were a couple of *Charis argyrodines*, Bates, and one of the conspicuous black, yellow, and scarlet *Lymnas jarbus*, Fabr.

Heliconiines were not common, but I took *Heliconius charithonia*, Linn., and two of the beautiful black and red *H. hydara*, Hew. (one of the species into which the beautiful *H. melpomene*, Linn., has been split up); these last were both males, one only of which had a very strong odour, like acetylene, or, as Mr. G. H. Sworder of Tobago suggested, hazeline (*Hamamelis virginica*). This insect is tenacious of life.

I got but one *Papilio*, but its beauty was striking even among so many fine insects, for a male *P. cymochles*, Dbl., feeding on the flowers of Lantana is a sight worth going far to see. Its handsome black, scarlet, and cream-coloured livery is in itself a feast of colour, but when that marvellous violet-blue gloss is seen, words altogether fail one.

Among the Lycænids the wide ranging *Leptotes* (*Tarucus*) *cassius*, Cram., was by far the commonest, the sexes in about equal numbers;

next in order of abundance came *Tmolus palegon*, Cram., which frequented the flowers of a Composite shrub (? *Vernonia scorpiodes*, Pers.) ; of *Thecla rufofusca*, Hew., I captured two, but of the following only one each : *T. crolus*, Cram. ; *T. togarna*, Hew. ; *Theclopsis tephræa*, Hübn. (this had a peculiar, strong, rather disagreeable odour) ; *Callipsyche thius*, Hübn. ; and *Catochrysops hanno*, Stoll, this last sitting head downwards and opening its hind-wings at intervals.

The Pierines were represented by a fair number of species, but few of them were common, indeed, of the following single specimens only were taken : *Terias nise*, Cram., a male ; *T. leuce*, Boisd., a female, the only specimen met with ; *T. elathea*, Cram., a male, an aberration with the black streak obsolescent ; *Sphænogona gratiosa*, Dbl. and H., a female ; *Enantia (Dismorphia) melite*, Clerck, a male (two were netted, but unfortunately the female got away) ; and the "Black-White" *Euterpe critias*, Feld., a male ; as regards the last named I fear I did not notice at the time how closely it mimics some of the black and red *Papilios*, notably *P. serapis*, Boisd. (? *iphidamas*, Fabr.), a species that I took at Cartagena. The genus *Terias* was much to the fore ; in addition to those already mentioned several *T. albula*, Cram., were taken, some of them remarkably small ; also of *T. phiale*, Cram., four males ; and of *T. delia*, Cram., three females, all of "dry" type, and one of the extreme dry form named by Butler *persistens*. Two females of *Meganostoma cerbera*, Feld., were captured ; this species, of which Felder called the dry season form *therapis*, appears to me to be quite distinct from *M. cæsonia*, Stoll. Of *Daptonoura lycimnia*, Cram., I took one of each sex. Altogether I took six specimens of *Sphænogona arbela*, Hübn., four males of the ordinary yellow form (one of the form *xanthochlora*, Koll.), and a female of the unusual pale form. Undoubtedly the most conspicuous Pierine was the large and handsome "Brimstone" *Amynthia mærula*, Fabr. This was only seen on one especially hot morning (March 21st) when several of both sexes were observed flying strongly close by the Ithomiine locality ; I only secured one male, and as the day wore on the species disappeared.

There was more than the usual crowd of Skippers ; but in the Neotropical Region Skippers are so common, often so inconspicuous in colour, and the allied species so difficult to distinguish, that one is apt to neglect them in the presence of more attractive game ; for truly the most scientific Entomologist is but human !

Of the long-tailed *Eudamus proteus*, Linn., and *E. eurycles*, Latr.,

but one each was secured, though there were plenty about. Of *Prenes nyctelius*, Latr., I took two; of *Heliopetes laviana*, Hew., three; of *Hesperia syrichthus*, Fabr., two; of *Gorgythion begga*, Prittw., three. Of all the following there were but single examples in my bag:—*Cycloglypha thrasybulus*, Fabr.; *Chiomara gesta*, H.-S.;—the three species last named all curve the fore-wings downwards, like our *Thanaos tages*, Linn.—the conspicuous black and red *Pyrrhopyge charybdis*, Dbl. and H.; *Mylon zephus*, Butl.; *Cogia calchas*, H.-S.; *Epeus veleda*, Godm. and S.; *Mnestheus ithoria*, Butl.; *Pellicia*, sp. prop. *bromio*, Mab.; *P. dimidiata*, Ploetz; *Metron leucogaster*, Butl.; *Megistias telata*, H.-S.; *Methionopsis ina*, Ploetz; *Thymelicus dares*, Ploetz; and *Niconiades merenda*, Mab. But the most attractive of the group was *Carystus coryna*, Hew., with its brilliant "silver-washed" under-side; the only specimen seen—just where the upper water-course leaves the stream—was settled upon a mass of silvery-white shale, which shone in the sunlight with the same metallic lustre as the Butterfly. Possibly the result of mere chance, this is certainly the most remarkable instance of cryptic colouring that I have met with.

A few day-flying moths taken in the same locality must be mentioned; single specimens occurred of each. The Arctia-like Syntomid *Ctenucha venosa*, Walk., at the flowers of a white composite; the black Geometer with white transverse bar across the fore-wings *Ephialtias tryma*, Schaus; and the black, orange-tipped Geometer *Josiomorpha cruciata*, Butl., which proved tenacious of life. These, with a very elegant Agrionine Dragon-fly having carmine patches at the base of the wings (near to *Agrion brightwelli*, Kirby, and *caja*, Dru.), complete my list of captures in the best locality that it has been my good fortune to visit.

The arc-light in the patio of the (not very) Grand Hotel proved extremely attractive to big moths as well as to numerous large Locustids.

Syntomids:—*Cosmosoma teuthras*, Walk., one; *Eucereon setosum*, Sepp, two.

Arctiids:—*Bertholdia specularis*, H.-S., a beautiful insect, one; *Ammalo insulata*, Walk., two; *Utetheisa ornatrix*, Linn., one; *Ecpantheria muzina*, Oberth., one.

Sphingid:—*Dilophonota ello*, Linn., three.

Noctuids:—The Boarmid-like *Synia hypnosis*, Hübn., one; the huge and variable *Erebus odorus*, Linn., quite common, ten; *E. zenobia*, Fabr., one; and the Quadrifid Yellow Under-wing *Hypocala filicornis*, Guen., one. To these must be added the Boarmid Geometer *Oxydia verulia*, Cram.

The large Skipper, *Perichares corydon*, Fabr., turned up in one of the court-yards by day, and a recently dead specimen of the Nymphaline, *Catonephele nyctimus*, Westw., a male, was found on the floor.

With the moths were numerous big Locustids, allied to the Katydid; a green Phaneropterine and a brown Conocephaline.

On March 29th, proceeding to La Guaira to join the homeward-bound steamer, we got out at Zigzag station, 1500 ft. above the sea, and completed the journey on foot, a walk that I should much like to repeat. The road, right down to the coast, presented all the appearance of very heavy rain within a few days previously. Insects were most numerous between the station and about 1000 ft., below this vegetation became sparse, and later on clouds overspread the sky. The most abundant butterfly was *Phyciodes leucodesma*, Feld., with its somewhat gliding flight, but *P. anieta*, Hew., and *Terias albula*, Cram., were also common, as was the handsome scarlet and black *Heliconius hydara*, Hew. A much smaller, but lovely black and red butterfly, *Hæmatera pyramus*, Fabr., was taken on the railway track. Other Nymphalines captured were *Colænis julia*, Fabr., two; *Nica canthara*, Dbl., one; *Anartia amalthea*, Linn., two; *Dynamine sara*, Bates, three; *Synchloë lacinia*, Hübn., two of the dark form, the third of f. *saundersii*, Dbl. and H.; and *Cystineura cana*, Erichs., two, a ghostly looking thing with gliding flight, somewhat like a *Neptis*.

The only Ithomiines met with were *Tithorea furia*, Stdgr., of which I took a female at about 1300 ft., and *Pteronymia victorina*, Hew., of which I took one, and possibly saw others, at about 1000 ft. Of *Eueides isabella*, Cram., f. *hübneri*, Mén., I got but a single example. The Erycinids were limited to *Nymphidium molpe*, Hübn., and *Charis argyrodines*, Bates, one of each.

Satyrines were notable for quality rather than quantity, single specimens were taken of *Euptychia hermes*, Fabr.; *E. hesione*, Sulz., and *E. mollina*, Hübn., the last named a whitish species not taken elsewhere.

Skippers were but moderately numerous, those taken were: *Chiomara gesta*, H.-S., one; the very neat little *Heliopetes domicella*, Erich., three; *Zophyrion satyrina*, Feld., one, a species well named, since the ocelli on its under surface are very suggestive of a Satyrid; and *Staphylus mazans*, Reak. (*ascalaphus*, Stdgr.), one.

If Skippers were but moderately numerous, Blues were decidedly scarce, for my bag included only *Thecla rufofusca*, Hew., one, at about 750 ft., and *T. togarna*, Hew., two, one taken just below Zigzag, the other as low as 500 ft.

Pierines were fairly numerous, but not so easy to catch, conspicuous among them was *Callidryas eubule*, Linn., though not really common, the specimens were large. Of *Sphænogona gratiosa*, Dbl. and H., a female was taken, but others seen (at Cartagena this butterfly was noted as flying low and *through* bushes); a *female Daptonoura lycimnia*, Cram. (f. *polyhymnia*, Feld.), contrary to precedents, had a rich sweet scent. Of *Pieris calydonia*, Boisd., I brought home two males, also a male of another *Pieris*, of which Dr. Dixey says:—"probably undescribed, near *sevata*, Feld." This was taken at an altitude of about 1300 ft., close to the track. There were several good-sized Whites about that declined to be caught, it is possible that among them there may have been others of this interesting species.

Between 2 and 4 p.m., from about 1000 ft. down to about 500 ft., the Hypsid day-flying moth, *Phaloë lorza*, Boisd., was in abundance. Its flight is slow and heavy, suggesting a pale, dingy *Heliconius*; nine specimens were taken, eight of them proved to be females. Among the last butterflies taken were *Phyciodes liriope*, Cram., and a tattered *Hypanartia lethe*, Fabr., both at about 750 ft.

At the decidedly dirty Hotel Neptuno, a fine specimen of the large Brassoline, *Caligo memnon*, Feld., was awaiting my arrival; it had been pinned upon the wall two days before by the obliging interpreter who knew my fancies.

The next morning was devoted to a stroll along the coast towards the east, anxiety as to the arrival of the steamer preventing any lengthy expedition. The best spot reached was a neglected cemetery by the sea-side, where we found *Phyciodes leucodesma*, Feld., common; *P. liriope*, Cram.; *Anartia amalthea*, Linn., tattered; *Terias albula*, Cram., common, one very large; *Pieris phileta*, Fabr. (*monuste*, auct.), two males—this species I have always met with close to the shore; *P. calydonia*, Boisd., a male; *Nica canthara*, Dbl., two; *Mechanitis veritabilis*, Butl., one; *Heliopetes arsalte*, Linn., one; another Skipper was *Bolla* sp., of which three specimens were obtained (Mr. H. H. Druce says that there is one specimen of this species in the Godman collection unnamed)*; and *Ageronia ferentina*, Godt., settled on the pale grey trunk of a palm, which it closely matched in colour.

Anosia archippus, Fabr., was seen a little way beyond the cemetery on a purple-flowered *Asclepias*.

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* I have to thank Mr. H. H. Druce for the great trouble that he took in determining my Blues and Skippers.

While walking down to the ship I picked up from the pavement a fine water-beetle, *Hydrophilus insularis*, Casteln.

So ended my fortnight in Venezuela, yielding in butterflies alone 492 specimens, of 124 species, of which 53 were represented by single examples. Let me add that I found the Venezuelans civility itself, and my operations were in no wise interfered with.

Twitchen, Mortehoe, R.S.O.:

December 12*th*, 1907.

XIV. *Studies of the* Blattidæ. By R. Shelford, M.A., F.L.S.

[Read June 6th, 1906.]

PLATES XIV—XVI.

I.

Remarks on the Sub-Families Ectobiinæ and Phyllodromiinæ.

A careful study of the genera composing the sub-families Ectobiinæ and Phyllodromiinæ has convinced me that the characters usually employed to discriminate the members of the respective sub-families are so diverse in structure even within generic limits that but little reliance can be placed on them as criteria of distinction. The short transverse supra-anal lamina, the presence of a triangular apical field in the wings or of a large reflected apical area, and the sparse armature of the femora are the so-called diagnostic features of the Ectobiinæ. Yet nearly all the species of the genus *Anaplecta*, and many species of the genus *Theganopteryx* have the supra-anal lamina produced and triangular; again, the triangular apical field appears in numerous species of Phyllodromiinæ, sometimes much reduced in size but often as large as in *Ectobia lapponica*, L.; now as the presence of this apical field is more or less a mechanical result of a peculiar method of wing-folding, it is a character that may be expected to re-appear in other sub-families of *Blattidæ*, and such indeed is found to be the case, too much importance therefore should not be attached to it alone as a diagnostic feature. The armature of the femora is also unsatisfactory; for though the posterior femora of *Ectobia* and of *Anaplecta* are armed with only two spines on the anterior margin beneath, in *Pseudectobia* and *Theganopteryx* they are frequently strongly spined, whilst in *Chrastoblatta* and *Caloblatta*, two Phyllodromiine genera, the femora are most sparsely armed. It will be

seen by the foregoing that the Ectobiinæ and Phyllodromiinæ possess features common to both sub-families, and the question arises as to whether there does exist a character that can be relied on as a diagnostic criterion of sub-family rank. I own to having been nearly completely baffled in my search for such a character, and I have seriously considered the advisability of transferring the genera *Ectobia* and *Hololampra* (= *Aphlebia*) to the Phyllodromiinæ, leaving in the depauperated Ectobiinæ—henceforth to be called, following de Saussure, the Anaplectinæ—only the genus *Anaplecta* and a new genus described below.

However, it is not necessary to make such a revolutionary change, for I believe that I have hit on a feature of great use in distinguishing the members of the two sub-families in question, namely, the form of the vena ulnaris of the wing. This vein is either simple or bifurcated or else ramose, and it is to be noted that when this vein is ramose a reduction in size of the triangular apical field generally ensues, the reduction leading on in many cases to entire obliteration. Moreover it is possible to trace a shifting backwards of the apical triangle; in *Ectobia lapponica*, L., this field is close to the anterior margin of the wing so that the median vein and ulnar vein impinge on its upper border, and do not attain the outer margin of the wing; in such a species as *Theganopteryx conspersa*, Sss., the apical triangle is shifted back so that the median vein and the upper branch of the bifurcated ulnar vein reach the outer margin of the wing, anterior to the apical triangle and only the lower branch of the ulnar vein impinges on it; in many species of *Phyllodromia* the median vein and the numerous branches of a ramose ulnar vein all reach the outer margin of the wing, the apical triangle having undergone a further backward shifting; finally we have those forms, such as the species of *Pseudomops* in which the apical triangle has disappeared entirely, and in these the anterior part of the wing projects beyond the posterior part, producing a marked sinuosity of the outer margin. Taking into consideration the great range of variation of these characters, I find it not possible to use them as criteria of sub-family rank, except to this extent, that all forms with a single or bifurcate ulnar vein and a conspicuous triangular apical field may be regarded as Ectobiinæ, and those forms with ramose ulnar vein as Phyllodromiinæ, whether the apical triangle is present reduced or absent.

Brief diagnoses of these two sub-families may be given as follows:—

ECTOBIINÆ.—*Femora spined beneath; sub-genital lamina of female not provided with valves; supra-anal lamina not quadrate or lobate; wings when present with a conspicuous triangular apical field or reflected apical area, the ulnar vein simple or bifurcate; tarsi without pulvilli.*

PHYLLODROMIINÆ.—*Femora spined beneath; sub-genital lamina of female not provided with valves; supra-anal lamina not quadrate or lobate; wings when present with or without a triangular apical field, never with a reflected apical area, the ulnar vein ramose; tarsi without pulvilli.*

In spite of this new importance attached to the form of the vena ulnaris of the wings only three changes of genera are necessitated, viz. *Pseudectobia* is transferred from the Ectobiinæ to the Phyllodromiinæ; *Hemithyrsocera*, Sss., and *Mallotoblatta*, Sss. and Zhntn., from the Phyllodromiinæ to the Ectobiinæ. *Pseudectobia* was considered by de Saussure as a division only of the genus *Theganopteryx*, Br., but such species as *P. insularis*, Sss., and *P. liturifera*, Stål., in their general facies are quite Phyllodromiine in appearance and moreover have the femora strongly spined, whilst the supra-anal lamina in some species is produced. *Hemithyrsocera nigra*, Br., and *H. histrio*, Burm., have been actually re-described by de Saussure (Mél. Orthopt. ii, pp. 50 and 52, 1869) as *Theganopteryx indica* and *Th. jucunda* respectively, surely sufficient testimony to the difficulty of discriminating between Ectobiinæ and Phyllodromiinæ, if no account is taken of the form of the vena ulnaris alarum. *Mallotoblatta* is placed by de Saussure and Zehntner with some doubt in the Phyllodromiinæ, and the sub-family Ectobiinæ is suggested by these authors as the correct resting-place for this interesting genus. If the form of the vena ulnaris alarum in conjunction with the extent of the triangular apical field is consulted by systematists, I believe that little or no difficulty will be experienced in deciding into which of the two sub-families a given species is to be placed. Some exceptions, it is true, must be noted; firstly, the new genus described below on page 247, which, though quite evidently closely allied to *Anaplecta*, nevertheless has the vena ulnaris alarum ramose; secondly, *Phyllodromia*

germanica, L., and allied species such as *P. parenthesis*, Gerst., *P. madecassa*, Sss., and *P. humbertiana*, Sss., which have the vena ulnaris alarum simple or bifurcate; in these species however the triangular apical field is much reduced, and for the present they must be regarded as forms transitional between the Phyllodromiinæ and Ectobiinæ. The species *difficilis*, Sss., and *massuæ*, Sss., I remove from the genus *Phyllodromia* to *Theganopteryx;* in these the supra-anal lamina is shortly produced or transverse, which character in conjunction with the prominent triangular field and simple or bifurcate vena ulnaris, renders their transfer only logical.

The genus *Pachnepteryx*, Br., I am unable to place with certainty since I have seen no examples and the wing-venation of the known species has never been described. It is quite evident that *Thyrsocera histrio*, Burm., cannot be referred to the genus *Pachnepteryx* as suggested by Brunner (Nouv. Syst. des Blatt., p. 116, 1865), it belongs to the genus *Hemithyrsocera.* I agree with de Saussure in relegating *Chorisoneura* to the sub-family Oxyhaloinæ (= Plectopterinæ).

Genus Mallotoblatta, Sss. and Zhntn.

Mallotoblatta obscura, n. sp.

♂. Head, pronotum and tegmina with sparse erect hairs. Rufo-castaneous. Vertex, antennæ at the base, abdomen, legs and cerci testaceous. Pronotum trapezoidal, sides deflexed with the lateral and anterior margins hyaline, disc rufo-castaneous with sometimes an irregular central macula testaceous in colour. Mediastinal and marginal fields of tegmina hyaline; wings hyaline with the veins rufo-fuscous. Tegmina with thirteen to fifteen costal veins, the most distal ones branched, radial vein bifurcated, discoidal field traversed by six longitudinal veins, anal vein reaching the sutural margin at one-third of its length. Wings with nine to ten costal veins, their extremities swollen, radial vein bifurcated, median vein simple, ulnar vein simple, first axillary vein bifurcated, triangular apical field prominent, projecting beyond the anterior part of the wing. Anterior femora armed on the anterior margin beneath in the proximal half with three long spines, in the distal half with numerous short spines (type A of de Saussure); the posterior femora are armed with five spines on each border beneath; the formula of the apical spines is $\frac{1}{1}$, $\frac{1}{1}$, $\frac{1}{0}$; a genicular spine is absent from the

anterior femora. Supra-anal lamina slightly produced, trigonal; sub-genital lamina produced, irregular in shape, without styles; cerci mutilated. On each side of the middle line of the sixth abdominal tergum appears a mamilliform tubercle with a small orifice at the summit of each.

Total length 10 mm.; length of tegmina 7 mm.

MADRAS. Five examples. (Oxford Museum.)

The specimens are in bad condition, and the erect hairs in some examples have been rubbed off. I have no doubt however of the correct generic position of the species.

Genus THEGANOPTERYX, Br.

Theganopteryx apicigera, Wlk.
Blatta apicigera, Walker, Cat. Blatt. B. M. p. 227 (1868).

♂ and ♀. Rufo-testaceous or flavo-testaceous. Head, antennæ, legs and cerci fusco-castaneous; abdomen testaceous above, darker below. Pronotum trapezoidal, sides not deflexed, with hyaline lateral margins. Tegmina with the apices fuscous, the part of the right tegmen overlapped by the left, hyaline, twelve costal veins, anterior ulnar vein quadri-ramose, posterior ulnar vein simple. Wings hyaline, apex infuscated, marginal field flavo-testaceous, ten to eleven costal veins, their extremities swollen, median vein simple, ulnar vein bifurcate, first axillary vein tri-ramose, triangular apical field conspicuous but not projecting beyond the anterior part of the wing. Anterior femora not spined beneath, mid- and posterior femora with two or three spines only on each margin beneath; formula of apical spines $\frac{1}{1}$, $\frac{1}{1}$, $\frac{1}{1}$; no genicular spine on anterior femora. Supra-anal lamina of male short, rounded, of female slightly produced; sub-genital lamina of male ample, with two styles. Ootheca with a longitudinal crest and carried with the crest uppermost, so that the eggs are vertically disposed. Cerci elongate.

Type (♀.)	Total length	11 mm.;	length of tegmina	9·5 mm.
♂.	,, ,,	9 mm.;	,, ,,	8 mm.
♀.	,, ,,	11 to 12 mm.;	length of tegmina	9 to 10 mm.

JAVA (*Wallace*—Type), SUMATRA (*Weyers*), SARAWAK, BORNEO (*Shelford*). Nine examples. (Oxford Museum.)

The position of the ootheca when carried by the female before deposition is not a character of sub-family import-

ance; in all the Ectobiinæ the ootheca is carried in the way described above, but it is so carried also by *Ellipsidium* and some species even of *Phyllodromia.*

Theganopteryx bouvieri, n. sp.

♂. Testaceous. Head rufous, antennæ testaceous; pronotum rufous, with hyaline borders, a central line and a broad crescentic macula in the hinder part of the disc, testaceous; tegmina pale testaceous, hyaline; wings hyaline with the veins testaceous; abdomen above rufous, beneath castaneous; legs and cerci rufous. Pronotum transversely hexagonal, the postero-lateral borders one-third the length of the posterior margin; the posterior margin obtusely angled. Tegmina with twenty-one costal veins; ulnar vein with eleven oblique branches, posterior ulnar not visible. Wings with seventeen costal veins, the last two or three bifurcate, their extremities slightly swollen, ulnar vein bifurcate before the middle, first axillary vein tri-ramose, triangular apical field large, but not projecting beyond the anterior part of wing. Anterior femora with no spines beneath, posterior femora with two spines on each margin beneath; formula of apical spines $\frac{1}{1}$, $\frac{1}{1}$, $\frac{1}{1}$; genicular spines on all the legs. Supra-anal lamina produced, triangular, sub-genital lamina without styles.

Total length 12·5 mm.; length of tegmina 10 mm.

Diego Suarez, Madagascar (*Alluaud*, April 1896). Seven examples. (Paris Museum.)

Named in honour of Professor Bouvier, to whom I am indebted for the opportunity of examining an interesting collection of *Blattidæ* in the Paris Museum.

Theganopteryx gambiensis, n. sp.

♂. Coloration almost the same as in *Ectobia lapponica*, L.; head piceous, antennæ fuscous; pronotum castaneous, anterior and lateral margins hyaline; tegmina flavo-testaceous, marginal field hyaline; wings infuscated; abdomen fuscous with testaceous lateral margins above and below, the last two segments and the supra anal lamina testaceous above; first pair of coxæ testaceous, second and third pairs tipped with testaceous, first pair of femora castaneous, second pair castaneous at apex and along lower margin the remainder testaceous, (third pair missing), tibiæ testaceous tipped with castaneous, spines testaceous; cerci fuscous. Tegmina with ten costal veins, radial vein ramose at extremity, anterior ulnar vein bifurcated, posterior ulnar multi-ramose. Wings as in *Ectobia*

lapponica, L. Supra-anal lamina shortly triangular; ante-penultimate segment with posterior border notched; sub-genital lamina produced, rounded, without styles, the sternum of the preceding segment represented by two lateral lappets, the central part concealed beneath the preceding sternum.

Total length 13 mm.; length of tegmina 11 mm.

GAMBIA. One example (Oxford Museum).

This species is remarkably like *Ectobia lapponica*, L., the resemblance extending to the wing structure; the venation of the tegmina is however sufficient to separate the species.

The following table shows the differences between the four known species of *Theganopteryx* from W. Africa:—

1. Pronotum bordered with hyaline.
  2. Tegmina not black.
    3. Tegmina with 20 to 22 costal veins, wing venation different from that of *E. lapponica* . . *T. senegalensis*, Sss.
    3′. Tegmina with 10 costal veins, wing venation exactly as in *E. lapponica* . . . . *T. gambiensis*, mihi.
  2′. Tegmina black . . . . *T. æthiopica*, Sss.
1′. Pronotum not bordered with hyaline . *T. nitida*, Borg.

Blatta amœna, Wlk., ♂, appears to be the same as *T. senegalensis*, Sss., but the female is a species of *Temnopteryx*; a specimen from Natal under the same name in the British Museum is a distinct species of *Theganopteryx*. I doubt if *Blatta fulvipes*, Wlk., can be separated from *Blatta amœna*, Wlk., ♂.

Theganopteryx æthiopica, Sauss.

The form of the "titillator" is shown in Plate XV, fig. 3, it is almost identical in *Th. senegalensis*, Sauss.

Genus HEMITHYRSOCERA, Sss.

This is not a satisfactory genus, unless it is restricted to one species, *histrio*, Burm., which has plumose antennæ in both sexes, and exhibits a remarkable form of sub-genital lamina in the male; in the other species the antennæ are inconspicuously pilose in the male sex and not pilose in the female, and there is really little to prevent the inclusion of

the species in the genus *Theganopteryx;* in some of the species the posterior ulnar vein of the tegmina is markedly angled, in others it is not. The form of the "titillator" in *H. lateralis*, Wlk. (= *H. major*, Br.) is shown in Plate XV, fig. 2, and is seen to be very different from that in *Th. æthiopica*, Sss.; unfortunately we know so little of the structure of this organ in the Blattidæ, that at present we can make no use of it in generic distinctions. The titillator of *H. histrio*, Burm., is almost the same as in *H. lateralis*, Wlk.

The synonymy of *Hemithyrsocera histrio*, Burm., is here given:—

Thyrsocera histrio, Burm., Handb. Ent. ii, p. 499, n. 7 (1838).

Blatta lateralis, Serv., Ins. Orth. p. 107 (1839).

Phyllodromia inversa, Br., Nouv. Syst. d. Blatt. p. 96, n. 8 (1865).

Pseudomops fissa, Wlk., Cat. Blatt. B. M., p. 213 (1868).

Theganopteryx jucunda, Sauss., Mel. Orth. ii, p. 52 (1869).

Thyrsocera lineaticollis, Bol., An. Soc. Españ. xix, p. 302 (1890).

The sub-genital lamina and adjacent parts in the male are figured on Plate XV, fig. 1.

Hemithyrsocera ignobilis, n. sp.

♀. Differs from *H. ferruginea*, Br., in its smaller size; the golden lateral margins of the pronotum reach the anterior margin, but are not curved inwards here to the extent that they are in *ferruginea*; the posterior legs and the tips of the cerci are ferrugineous.

Total length 12·5 mm.; length of tegmina 10 mm.

No locality. (An identical specimen in the British Museum comes from the Khasia Hills.)

One example (Oxford Museum).

Genus Escala, nov.

Allied to *Theganopteryx*, Br., but the sub-genital lamina of the male bearing an asymmetrical lobe which may be unarmed, or armed with a series of hooks or replaced by a stout hook; the right style sometimes absent, the left style accuminate. Supra-anal lamina produced, triangular, not projecting beyond the sub-genital

lamina; cerci elongate. Wings with median and ulnar veins simple, reaching the outer margin of the wing, anterior to the somewhat inconspicuous apical triangle.

Escala circumducta, Wlk. (Plate XV, fig. 4.)
Blatta circumducta, Walker, Cat. Blatt. B. M. Suppl. p. 142 (1869).

♂. Testaceous. Head rufo-castaneous; antennæ, palpi clypeus testaceous. Pronotum with the disc rufous, lateral and anterior margins hyaline and a central testaceous macula. Tegmina with twelve costal veins, mediastinal vein bifurcate, radial vein with extremity ramose. Wings clear hyaline, with ten costal veins, radial vein bifurcate near the apex, apical triangle elongate but narrow, first axillary vein tri-ramose. Posterior femora with three spines on anterior margin beneath, four on posterior margin; formula of apical spines, $\frac{1}{1}$, $\frac{1}{1}$, $\frac{1}{1}$, no genicular spine on anterior femora. Supra-anal lamina produced, triangular, but doubled on itself so that in dorsal view the apex cannot be seen and the lamina appears then to be short and transverse. Sub-genital lamina ample, semi-circular in outline. The left style acuminate, the right absent, the lobe bearing five curved hooks bent over the edge of the sub-genital plate. Cerci elongate.

Total length 14 mm.; length of tegmina 11·5 mm.

Adelaide, S. Australia. Five specimens, including the type (Oxford Museum).

Escala longiuscula, Wlk. (Plate XV, fig. 5.)
Blatta longiuscula, Walker, Cat. Blatt. B. M. Suppl. p. 143 (1869).

♂. Testaceous; head rufo-testaceous; lateral and anterior margins of pronotum hyaline. Tegmina with nineteen costal veins, radial vein not bifurcate, not ramose at extremity, anterior ulnar vein bifurcate, posterior ulnar multi-ramose. Wings as in preceding species. Posterior femora with five spines on each margin beneath, formula of apical spines $\frac{1}{1}$, $\frac{1}{1}$, $\frac{1}{1}$, genicular spines on all the femora. Supra-anal lamina produced, trigonal; sub-genital lamina as in the preceding species, the right style absent, the lobe modified to form a stout double-pointed hook; cerci elongate, their apices curved downwards.

Total length 13 mm.; length of tegmina 11 mm.

Adelaide. Four examples, including the type (Oxford Museum).

Escala insignis, n. sp. (Plate XV, fig. 6.)

♂. Rufo-testaceous; head castaneous, anterior and lateral margins of pronotum hyaline; wings clear hyaline with rufous shading on either side of the apical triangle; abdomen and legs testaceous. Tegmina with thirteen costal veins, anterior ulnar vein bifurcate, posterior ulnar vein ramose. Wings with eleven costal veins, first axillary vein bifurcate, apical triangle larger than in the two preceding species. Supra-anal lamina not much produced, trigonal; subgenital lamina ample with two acuminate styles and an asymmetrical lobe, covered with short setæ but not armed with hooks.

Total length 11·5 mm.; length of tegmina 9·5 mm.

AUSTRALIA. Two examples (Oxford Museum).

This species is structurally very close to *Theganopteryx* and may be regarded as the least highly modified species of the genus *Escala*. In general facies the species resemble each other closely, but the nature of the sub-genital lamina affords admirable specific characteristics, and if this is examined there can be no possible difficulty in distinguishing the species. I have seen no female examples of the genus.

Genus ANAPLECTA, Burm.

Anaplecta maculata, n. sp. (Plate XV, fig. 7.)

♀. Castaneous; head rufous, antennæ fuscous; lateral margins of the pronotum and tegmina pellucid; a testaceous macula in the centre of the pronotum but nearer the posterior than the anterior margin; wings infuscated; the ventral surface of the abdomen, the legs and cerci testaceous. Tegmina with seven parallel costal veins, the discoidal field traversed by four longitudinal veins, the anal vein impressed. Wings with five costal veins joined by oblique venulæ, the marginal field not dilated, the medio-discal field crossed by six transverse venulæ, the first of which is oblique, no longitudinal vein dividing the apical part of the medio-discal field, two transverse venulæ anteriorly connecting the median with the ulnar vein, the first axillary vein tri-ramose, apical area two-fifths of total wing-length.

Total length 6·5 mm.; length of tegmina 5 mm.

PUNDALOYA, CEYLON (*E. E. Green* coll., Feb. 1897). Two examples (Oxford Museum).

This and at least two other species are in the British Museum under the label *Phyllodromia* (?) *gyrinoides*, Wlk. I have compared *A. maculata*, mihi, and the two

following species with Walker's type and find that they are quite different from it; *gyrinoides*, Wlk., also from Ceylon is undoubtedly a species of *Anaplecta*. The genus has not hitherto been recorded from Ceylon. *A. maculata* falls into the section of the genus that includes *A. major*, Sss. and Zhnt., *A. dohrniana*, Sss. and Zhnt.

Anaplecta zeylanica, n. sp. (Plate XV, fig. 8.)

♀. Small; rufo-castaneous; pronotum and tegmina with the lateral margins hyaline; legs and cerci testaceous. Tegmina with six costal veins, discoidal field with three longitudinal veins. Wings with the apical area, marginal field and veins pale fuscous, six costal veins, marginal field slightly dilated, medio-discal field crossed by four transverse venulæ and the median vein connected with the ulnar vein by two transverse venulæ near the apex, first axillary vein tri-ramose, apical area parabolic, its basal margin not angled, nearly one-half of total wing-length. Supra-anal lamina produced, trigonal.

Total length, 4 mm.; length of tegmina, 3·7 mm.

Ceylon (*Thwaites*, 1872). One example (Oxford Museum).

It is possible that the species is conspecific with *A. fulva*, Br., from Burma, but the description of that species does not include an account of the wing venation.

Anaplecta thwaitesi, n. sp. (Plate XV, fig. 9.)

♀. Head castaneous; pronotum castaneous with broad hyaline lateral margins; tegmina flavo-hyaline, wings with the apical area, marginal field and veins fuscous; abdomen fuscous; legs and cerci testaceous. Tegmina with eleven costal veins, the ulnar vein multiramose, the bases of the mediastinal and median veins and the anal vein strongly marked with castaneous. Wings with six costal veins, their extremities swollen, the marginal field dilated, the first bifurcated and connected with the humeral branch of the radial vein by an oblique venula, a transverse venula joins the humeral and discoidal branches of the radial vein near their point of origin, medio-discal field crossed by five transverse venulæ, ulnar vein bifurcate, first axillary vein quadri-ramose, apical area parabolic, its base slightly obtusely angled, two-fifths of total wing-length. Supra-anal lamina produced, trigonal, slightly emarginate.

Total length 6 mm.; length of tegmina 5 mm.

Ceylon (*Thwaites*). One example (Oxford Museum).

Anaplecta malayensis, sp. n. (Plate XV, fig. 10.)

♂ and ♀. Fusco-castaneous, lateral margins of pronotum and tegmina hyaline. Tegmina with seven costal veins, discoidal field traversed by four longitudinal veins, anal vein impressed. Wings with marginal field and apical area fuscous, with five costal veins, marginal field not dilated, radial vein bifurcate, medio-discal field crossed by three to four transverse venulæ, ulnar field half as broad, first axillary vein tri-ramose, apical area two-fifths of total wing-length, its basal margin obtusely angled.

♂. Total length 5 mm.; length of tegmina 4 mm. ♀. Total length 5 mm.; length of tegmina 4·8 mm.

MALAY PENINSULA (*Errington de la Croix* and *P. Chapé*. 1899). Three examples (Paris Museum).

Anaplecta obscura, sp. n. (Plate XV, fig. 12.)

♀. Fusco-castaneous, smooth, shining. Head piceous, maxillary palpi testaceous, antennæ fuscous; lateral margins of pronotum and mediastinal fields of tegmina hyaline; centre of abdomen beneath, legs and cerci testaceous; wings with the marginal field and most of the apical area infuscated, an oblique pale fascia crosses the upper half of the apical area. Wings with the marginal field dilated, seven costal veins, median vein obsolescent, curving from the apex of the radial vein to join it again near its middle, thus forming a trapezoidal areolet, 1st axillary vein bi-ramose, a short branch being given off from the transverse bar joining the two rami, apical area equals half the total wing-length, its basal margin straight.

Total length 4 mm.; length of tegmina 3·5 mm.

MALAY PENINSULA (*Errington de la Croix* and *P. Chapé*, 1899). One example (Paris Museum).

The great reduction in the extent of the wing-venation is alone sufficiently diagnostic of this interesting little species.

Anaplecta borneensis, n. sp. (Plate XV, fig. 11.)

♀. Fusco-castaneous; lateral margins of pronotum and tegmina hyaline. Tegmina with eight costal veins, discoidal area traversed by three longitudinal veins, reticulated. Wings hyaline, apical area slightly infuscated; four costal veins, the last obsolescent, radial vein bifurcated, medio-discal area crossed by two transverse venulæ near the middle and by two short oblique venulæ at the apex, first axillary vein tri-ramose, apical area divided unequally by one longitudinal

vein, apex incised, basal margin very obtusely angled, about two-fifths of total wing-length. Supra-anal lamina slightly produced. Legs testaceous.

Total length 4·8 mm.; length of tegmina, 4 mm.

KUCHING, SARAWAK. Three examples. [No. E.] (Oxford Museum.)

The following table will help to show the differences between the various Oriental species:—

1. Rufo-castaneous or fulvous.
   2. Medio-discal field of wing with five transverse venules, ulnar vein bifurcated, ulnar field without transverse venules . . . . *A. thwaitesi*, mihi (Ceylon)
   2′. Medio-discal field of wing with four transverse venules, ulnar vein simple, ulnar field with two transverse venules . . . . *A. zeylanica*, mihi (Ceylon)

1′. Fusco-castaneous.
   2. Disc of pronotum with pale central macula . . . . *A. maculata*, mihi (Ceylon)
   2′. Disc of pronotum without pale central macula.
      3. Median vein of wing obsolescent at its distal end . . . . . . *A. obscura*, mihi (Malay Peninsula)
      3′. Median vein of wing not obsolescent at its distal end.
         4. Medio-discal field of wing with four venules.
            5. These venules transverse, apex of apical area not incised . . . . *A. malayensis*, mihi (Malay Peninsula)
            5′. Two proximal venules, very oblique, apex of apical area incised . . . . *A. borneensis*, mihi (Borneo)
         4′. Medio-discal field of wing with two transverse venules. . . . *A. javanica*, Sss. (Java)

I have not been able to examine critically *A. gyrinoides*, Wlk., from Ceylon, the type of which is in the British Museum, however it enters into Sect. 1′ in the above table but can be readily distinguished by the fulvo-testaceous pronotum. *A. fulva*, Br., from Burma belongs to Sect. 1 in

the table, but as the wing venation of the species has not been described, it is not possible to show how it differs from the two Ceylon species.

Anaplecta pulchra, sp. n.

♀. Flavo-testaceous. Antennæ fuscous, except the two basal joints, and five joints close to the apex which are flavo-testaceous ; pronotum with hyaline lateral margins ; tegmina transparent ; wings deeply infuscated, the anterior border of the marginal field, the proximal halves of the radial, ulnar and first axillary veins yellow ; apex of abdomen beneath castaneous, the remainder bright flavous. Tegmina with eight costal veins, discoidal field with six longitudinal veins, anal vein impressed, axillary veins obsolete. Wings with six costal veins, the radial vein bifurcated, the median vein curved distally up towards the radial vein, the medio-discal field crossed by one proximal transverse venule, first axillary vein tri-ramose, apical area nearly half the total wing-length. Supra-anal lamina produced, trigonal.

Total length 6 mm. ; length of tegmina 4·5 mm.

FERNANDO PO (*L. Conradt*, 1901). One example (Paris Museum).

Anaplecta dahomensis, n. sp. (Plate XVI, fig. 2.)

♂ and ♀. Fusco-castaneous. Labrum and clypeus rufous ; apical seven joints of antennæ testaceous, the last tipped with fuscous. Prothorax piceous, its lateral margins broadly bordered with semi-opaque white. Tegmina entirely fusco-castaneous, with eight to nine costal veins, the discoidal field traversed by four longitudinal veins which are strongly marked. Wings hyaline, the marginal field and apical area infuscated, the axillary area iridescent fuscous ; six to seven costal veins, the radial vein bifurcated but the branches soon reunite forming an areolet which is crossed by a transverse venule, the median vein obsolescent proximally where it is joined by a transverse venule to the radial vein, the ulnar vein simple, the first axillary vein tri-ramose, apical area nearly one-half of total wing-length, its basal margin straight. Second and third pairs of legs and cerci testaceous, first pair of legs fuscous, except the distal extremity of the tibiæ and tarsi.

Total length 5 mm. ; length of tegmina 4·2 mm.

ATHIÉMÉ, DAHOMEY. A long series (Oxford Museum).

The species differs from *A. cincta*, Gerst., by the absence of a white border to the tegmina, by the strongly-marked veins of discoidal field of the tegmina, by the different colour of the legs.

Anaplecta brunneri, n. sp. (Plate XVI, fig. 1.)

♂ and ♀. Rufo-testaceous, vertex of head darker; antennæ fuscous except at the base. Lateral margins of pronotum and of tegmina as far as termination of mediastinal vein hyaline; legs and cerci testaceous. Tegmina with ten to eleven costal veins, the last two or three irregular, discoidal field with three longitudinal veins, anal vein well marked. Wings infuscated, with seven costal veins, their ends slightly swollen, the medio-discal field crossed by three venulæ, the proximal one bifurcated, the median vein obsolescent proximally, distally bent up to join the radial vein before its apex, anterior ulnar vein simple, posterior ulnar obsolescent distally, first axillary vein quadri-ramose, apical area as long as broad, two-fifths of total wing-length, its basal margin straight. Supra-anal lamina produced, its posterior border rounded, sub-genital lamina of male with one style, the left.

Total length 6 mm.; length of tegmina 5 mm.

Rio Grande do Sul, Brazil. Three examples (Oxford Museum).

The only two species with which this can possibly be confused are *A. pallida*, Bol., from Ecuador, and *A. fulgida*, Sss., from Mexico; from the former it differs by the narrow costal margin of the tegmina, by the smaller apical area of the wings, and by the smaller number of transverse venulæ in the medio-discal field of the wings; from *A. fulgida*, Sss., by the longitudinal discoidal veins of the tegmina, and by the different wing-venation.

Anaplecta pavida, n. sp. (Plate XVI, fig. 3.)

♀. Flavo-testaceous; pronotum almost orbicular with broad hyaline margins; abdomen fusco-testaceous; legs and cerci testaceous. Tegmina hyaline with an irregular fuscous macula at base of the median vein; ten costal veins, discoidal field with four longitudinal veins. Wings slightly infuscated, ten costal veins, medio-discal field crossed by two transverse venulæ, the distal one giving off an oblique longitudinal branch, one-fourth the length of the medio-discal field, first axillary vein quadri-ramose, apical area a little broader than long, one-fifth of total wing-length, basal margin obtusely angled. Supra-anal lamina produced, rounded.

Total length 6 mm.; length of tegmina 5 mm.

Cachabi, Ecuador (*W. F. H. Rosenberg* coll., Dec. 1896). One example (Oxford Museum).

The species is allied to *A. nahua*, Sss., from Mexico, but differs in coloration.

Anaplecta fusca, n. sp. (Plate XVI, fig. 4.)

♀. Minute; fusco-castaneous. Head piceous; pronotum elliptical, entirely dark castaneous-brown. Tegmina castaneous, with ten highly irregular costal veins connected with each other by transverse venulæ, discoidal field with two longitudinal veins, reticulated. Wings dark fuscous, five costal veins, radial vein with a humeral and a discoidal branch, median vein approximated to the radial vein and the very narrow medio-discal field crossed by two transverse venulæ, an oblique transverse venula runs from the apex of the ulnar vein to the median vein and from this two short obliquely longitudinal venulæ are given off, first axillary vein quadri-ramose. Apical area more than two-fifths of total wing-length, basal margin straight. Cerci golden-yellow, supra-anal lamina rounded.

Total length 4 mm.; length of tegmina 3·5 mm.

CACHABI, ECUADOR (*W. F. H. Rosenberg* coll., Dec. 1896). One example (Oxford Museum).

The venation of the tegmina and wings in this species is highly characteristic, and unlike that of any other known species.

Anaplecta varipennis, n. sp. (Plate XVI, figs. 5, 6.)

♀. Closely allied to *A. parvipennis*, Sss. and Zhnt., but differs in the following particulars:—the lateral borders of the pronotum and the mediastinal field of the tegmina are opaque white not hyaline, the clypeus is testaceous, the discoidal field of the tegmina is reticulated, the medio-discal field of the wings is crossed by two transverse venulæ, the sub-genital lamina is deeply cleft and has almost a valvular appearance. The tegmina vary in length from 4·8 mm. to 4 mm., the wings from 6 mm. to 3 mm., in the latter case the most notable reduction is that of the apical area which ranges in size from two-fifths of the total wing-length to one-sixth.

Total length 6·2 mm.

PARAMBA, ECUADOR, 3500 feet (*W. F. H. Rosenberg* coll., May 1897). Five examples (Oxford Museum).

In spite of the variation in size of the wings, their venation remains practically unaltered; as already noted, the most marked range of size is shown by the apical area

and the variation is almost an epitome of the changes whereby the small triangular apical field of such genera as *Ectobia* and *Theganopteryx* has become modified into the large parabolic apical area of the genus *Anaplecta.*

Anaplecta chrysoptera, n. sp. (Plate XVI, fig. 7.)

♀. Very convex. Rufous. Antennæ testaceous; third joint of maxillary palpi black; pronotum with lateral margins rufo-testaceous; abdomen and cerci castaneous, the apical joint of the latter yellow. Marginal field of tegmina nearly half the total breadth, thirteen parallel costal veins; the tegmina strongly overlap, veins of discoidal field of left tegmen obsolete, strongly marked in that part of the right tegmen which is covered by the left, the ulnar vein sends six branches to the sutural margin, anal vein strongly marked, axillary veins obsolete. Wings with the apical area and marginal field golden-yellow, fourteen costal veins, their ends slightly swollen, radial vein straight, medio-discal field crossed by eight transverse venulæ, ulnar vein simple, first axillary vein quadri-ramose, apical area two-fifths of total wing-length, its basal margin obtusely angled. Supra-anal lamina transverse, sub-genital lamina large, its posterior border shortly cleft and compressed laterally in the centre simulating a valvular appearance.

Total length 7·5 mm.; length of tegmina 6 mm.

AMAZONS (*H. W. Bates*). One example (Oxford Museum).

This somewhat remarkable species is most nearly allied to *A. flabellata,* Sss. and Zhnt. The unique example was labelled in Walker's handwriting "*Riatia sp.*"; the genus *Riatia* (type *R. pallicornis,* Wlk.) is too close to *Anaplecta* to be entitled to separate rank.

Genus ANAPLECTOIDEA, nov.

Differs from *Anaplecta,* Burm., in the branching of the ulnar vein of the wing. Elliptical, smooth, shining; vertex of head reaching anterior border of pronotum; eyes less remote than the insertions of the antennæ; pronotum transversely elliptical. Tegmina with marginal field very broad occupying almost half the total breadth. Ulnar vein multi-ramose, anal vein deeply impressed, axillary veins obsolete. Wings with numerous costal veins, medio-discal field crossed by numerous transverse venulæ, ulnar vein multi-ramose, the veins being given off towards the dividing vein, apical area small.

Supra-anal lamina slightly produced; sub-genital lamina large, spoon-shaped; cerci moderate.

The genus bears the same relation to *Anaplecta*, that *Pseudectobia* does to *Theganopteryx*.

Anaplectoidea nitida, n. sp. (Plate XVI, figs. 8, 9.)

♀. Rufo-castaneous; antennæ, tarsi and cerci rufo-testaceous. Lateral borders of the pronotum and mediastinal field of tegmina hyaline. Tegmina transparent, thirteen costal veins, ulnar vein with six branches. Wings infuscated, with twelve costal veins, their extremities swollen, medio-discal field crossed by eight transverse venulæ, ulnar vein with six branches, apical area broader than long, one-fifth total wing-length, its basal margin obtusely angled.

Total length 11 mm.; length of tegmina 9 mm.

BATCHIAN (*W. Doherty*), MACASSAR (*W. Doherty*). Two examples (Oxford Museum).

II. *The genera* PSEUDOMOPS, Serv., and THYRSOCERA, Burm., *of the sub-fam.* PHYLLODROMIINÆ.

There has been considerable confusion regarding those species of Phyllodromiinæ with incrassated antennæ and angulate ulnar veins in the tegmina. The steps whereby this confusion has grown may be summarized shortly as follows:—

The genus *Pseudomops* was founded in 1831 by Serville for the reception of the *Blatta oblongata* of Linnæus, though whether Serville's determination of the Linnæan species is correct is not certain. Burmeister in 1838 included in his genus *Thyrsocera* the species *spectabilis, crinicornis, cincta, affinis, flavipes, laticornis* (Perty), *histrio, oblongata* (Linn.), *annulicornis* and *hirticornis*; of these ten species eight are Neotropical, two (*spectabilis* and *histrio*) are Oriental; *spectabilis* must be selected as the type of the genus. Brunner, de Saussure, and other authors have ignored Serville's name *Pseudomops* and have employed *Thyrsocera* instead; however de Saussure in 1893 created the genus *Hemithyrsocera* for those Oriental species with a triangular apical triangle to the wings and with a simple or bifurcated vena ulnaris alarum; of this genus *jucunda* is

the type. Kirby (1904) employs the name *Pseudomops* for all the South American species placed by various authors in the genus *Thyrsocera*, six Oriental species are placed in the genus *Thyrsocera* and fourteen in the genus *Hemithyrsocera.* Rehn (1904) also applies *Pseudomops* to the Neotropical species, but sinks *Hemithyrsocera* as a synonym of *Thyrsocera, spectabilis* being selected as the type of that genus. An examination of most of the species on which these conclusions are based brings to light the following facts:—i. *Thyrsocera spectabilis,* Burm., is a Periplanetine, as shown by the valvular character of the last ventral segment of the female and by the wing-structure; *Ellipsidium speciosum,* Wlk., the type of which is in the Oxford Museum, is closely allied. Dr. A. Brauer, director of the Berlin Zoological Museum, has kindly favoured me with a drawing of Burmeister's type and a sketch of the subgenital lamina of that example, and there can be no doubt but that *Thyrsocera,* Burm., is a ditypic genus of the sub-fam. Periplanetinæ.

Thyrsocera may be re-described as follows:—

THYRSOCERA, Burm.

Antennæ incrassated in the basal half and hirsute, the hairs being longer and more dense on eight to ten joints just beyond the middle of the antennæ forming here a conspicuous tuft; third joint not longer than second. Head projecting slightly beyond the vertex; eyes and antennal sockets equally widely separated. Pronotum, smooth, trapezoidal, sides deflexed. Tegmina extending considerably beyond the abdomen with the marginal field broad, the veins in the basal part indistinct, marked by series of punctures. Wings with the basal half of the marginal field coriaceous, both radial and ulnar veins multi-ramose. Front femora with a serried series of short spines on the anterior margin beneath, with one or two spines only on the posterior margin, the other femora sparsely armed, all with apical spines on both margins and genicular spines. Tibiæ with spines in three rows above. Metatarsus equal in length to the remaining joints. Supra-anal lamina quadrate, cucullate with a median carina, its posterior border emarginate; sub-genital lamina of usual Periplanetine type. Cerci of moderate length, flattened and spatulate. Males unknown.

The two species may be distinguished as follows:—

Three joints beyond the antennal tuft white. Pronotum broadly

margined with yellow all round its border leaving a trefoil-shaped black centre.

Th. spectabilis, Burm. (NEPAL, CEYLON, MALACCA.) (Type in Berlin Museum.)

Two joints beyond the antennal tuft white. Pronotum with posterior margin and with two antero-lateral spots yellow, the black of the disc forming a cruciform figure. Ante-penultimate segment of abdomen beneath yellow.

Th. speciosa, Wlk. (E. INDIAN ARCHIPELAGO.) (Type in Oxford Museum.) (Plate XIV, fig. 5.)

ii. The Oriental species exclusive of *spectabilis*, hitherto included in the genus *Thyrsocera*, belong to two different genera, viz. one in which the vena ulnaris alarum is simple or ramose and an apical triangle present, *Hemithyrsocera*, Sss., another in which the vena ulnaris alarum is ramose and an apical triangle absent: for the latter species a new genus is created and may be diagnosed as follows :—

PSEUDOTHYRSOCERA, gen. nov.

Similar to *Pseudomops*, Serv., but with the anterior ulnar vein of the tegmina bifurcated instead of simple, and the pronotum truncate behind instead of produced. Antennæ more or less incrassated and plumose in both sexes, whereas in *Pseudomops* the antennæ are not always plumose in the male. Rami of the posterior ulnar vein of the tegmina angulate; ulnar vein of the wings ramose, but sending no branches towards the dividing vein.

The species to be included in this genus are :—

1. *P. scutigera*, Wlk.

   Pseudomops scutigera, Walker. Cat. Blatt. B. M. p. 212 (1868). (SARAWAK, BORNEO.)

2. *P. pica*, Walker.

   Pseudomops pica, Walker. Cat. Blatt. B. M. p. 213 (1868). (SUMATRA and SINGAPORE.)

3. *P. xanthophila*, Walker.

   Blatta xanthophila, Walker. Cat. Blatt. B. M. p. 230 (1868). (MENADO, CELEBES.)

The types of these are in the Oxford Museum.

4. *P. montana*, n. sp.

♂. Piceous. Head piceous, a triangular ochreous spot below the eyes, basal joints of maxillary palpi rufous, antennæ slightly incrassated, black. Pronotum trapezoidal, not covering the vertex, sides deflexed, posterior margin rounded, slightly produced. Tegmina piceous, apex of mediastinal field testaceous, sixteen to seventeen costal veins, discoidal field with six longitudinal sectors. Wings infuscated, ulnar vein tri-ramose. Abdomen, coxæ and femora rufous; cerci, apices of femora, tibiæ and tarsi black, tibial spines rufous. Supra-anal lamina produced, trigonal, sub-genital lamina trapezoidal, with one style.

Total length 16 mm.; length of tegmina 12·5 mm.

MT. MATANG, 3000 feet, SARAWAK, BORNEO.

Two examples (Oxford Museum).

The species in general facies approaches the genus *Pseudomops.*

5. *P. ruficollis*, n. sp. (Plate XIV, fig. 6.)

♂. Head and pronotum bright rufous; eyes, antennæ (mutilated) and maxillary palpi black. Tegmina black, a white spot on each mediastinal area and at the base of each anal field. Wings fuscous. Abdomen black. Coxæ with their distal ends and outer borders testaceous-white; the remaining joints of the legs are missing.

Total length 16 mm.; length of tegmina 13·2 mm.

PENANG (*Cantor*). One example.

The arrangement of the veins of the tegmina is the same as in *P. pica*, Wlk., and to that species this one is most nearly allied, and I expect that the antennæ when perfect specimens are taken will be found to be plumose in the basal half as in *P. pica.* The insect is remarkably fusiform and both in colour and in shape is very like an Elaterid beetle.

iii. The genus Hemithyrsocera, Sss., for reasons already given, has been transferred to the sub-fam. Ectobiinæ; the type species is *H. histrio*, Burm., since with this *H. jucunda*, Sss., is synonymous (*vide antea*).

The determination of the species of the genus *Pseudomops* is attended with some difficulty owing to the brevity of the diagnoses of the older authors and to the great variability of some of the species. I have been at some

trouble to determine with accuracy those species that are contained in the Oxford Museum, and I think that the subjoined list and notes made in the course of my labours may be of assistance to other workers in this order of Insects. I should like to record here my grateful thanks to Dr. O. Taschenberg of the Halle Museum who kindly lent me the type of *P. affinis*, Burm., and one or two other interesting examples of the genus; also to Dr. A. Brauer of Berlin for admirable drawings of the types of *P. flavipes*, Burm., *P. annulicornis*, Burm., *Blatta discoidalis*, Burm., and *B. discicollis*, Burm.

List of Species of the Genus Pseudomops, Serv.

I. Cerci not spatulate.

1. *P. oblongata*, L. (Surinam.)

Blatta oblongata, Linnæus, Syst. Nat. (ed. x), i, p. 425, n. 9 (1758); De Geer, Mém. Ins. iii, p. 541, pl. 44, ff. 11, 12 (1773).
Thyrsocera oblongata, Burmeister, Handb. Ent. ii, p. 449, n. 8 (1838).

In spite of de Geer's admirable description and readily recognizable figure, subsequent authors have confused another species, *P. intercepta*, Burm., with this, explaining discrepancies in appearance as due to variability; the pattern of the pronotum is so different in the two species that I see no valid reason for confounding them. The general colour of the insect is fulvous and the disc of the pronotum is marked by two dark points which may be joined and by a crescentic dark band near the posterior margin.

2. *P. intercepta*, Burm. (Mexico, Guatemala, Honduras.)

Blatta intercepta, Burmeister, l. c. p. 497, n. 10 (1838); de Saussure, Mém. Mex. Blatt, p. 113 (1864).
Pseudomops oblongata, Serville, Ins. Orth. p. 115 (1839).
Thyrsocera oblongata, Brunner, Nouv. Syst. d. Blatt. p. 121, n. 8, pl. iii, f. 11 (1865); de Saussure, Miss. Mex. Orth. p. 50, pl. i, f. 29 (1870); de Saussure and Zehntner, Biol. Centr.-Amer. Orth. i, p. 32, n. 3 (1893).

Thyrsocera tolteca, de Saussure, Rev. Zool. (2) xiv, p. 168 (1862); Mém. Mex. Blatt. p. 124, pl. i, f. 21 (1864); Brunner, l. c. p. 125, n. 18 (1865).

I agree with Kirby in regarding this as quite distinct from *P. oblongata,* L.; de Saussure and Zehntner on the other hand sink it as a synonym of *P. oblongata,* L. Good figures of the species have been published, so that it can be readily recognized.

3. *P. inclusa,* Wlk. (Brazil, Pernambuco.)

Pseudomops inclusa, Walker, Cat. Blatt. B. M. p. 212 (1868).
Thyrsocera amœna, de Saussure, Mél. Orthop. fasc. iv, p. 97 (1872).

The species can easily be distinguished by the horseshoe-shaped dark mark on the pronotum. In some specimens this may be considerably reduced, but it is never entirely absent; the dark shadings on the tegmina are subject to considerable variation. The type of *inclusa* is in the Oxford Museum.

4. *P. laticornis,* Perty. (Brazil.)

Blatta laticornis, Perty, Del. Anim. Art. p. 117, pl. 23, f. 4 (1834); Serville, l. c. p. 116 (1839).
Thyrsocera laticornis, Burmeister, l. c. p. 499, n. 6 (1838); Brunner, l. c. p. 123, n. 11 (1865); de Saussure, Miss. Mex. Orth. p. 51 (1870).
Thyrsocera dubia, de Saussure, Rev. Zool. (2), xiv, p. 168 (1862); Mém. Mex. Blatt. p. 123 (1864); Brunner, l. c. p. 124, n. 12 (1865).
Pseudomops concinna, Walker, l. c. p. 82, n. 20 (1868).

Perty's excellent figure is a valuable aid to the identification of this species; from the Halle Museum I received two examples which I was able to identify without much doubt. The following is a short description of them:

♂. Head red, shading to darker on the labrum, antennæ black with a testaceous annulus occupying eight joints, base scarcely incrassated; pronotum rufous shading to fuscous posteriorly, borders testaceous; tegmina fuscous, distal half of mediastinal field and centre of marginal field testaceous; abdomen rufo-fuscous, cerci

fuscous broadly tipped with testaceous; legs rufo-fuscous, coxæ tipped with testaceous. Length of pronotum 2·8 mm.; of tegmina 10·5 mm. ♀. Vertex only of head red, antennæ incrassated at base, the testaceous annulus occupying fourteen joints; pronotum rufous with a fuscous curved line posteriorly; tegmina fuscous with a broad testaceous vitta extending from distal half of mediastinal field and occupying the whole of the marginal field to near the apex of the tegmina, posteriorly the tegmina are fusco-hyaline; abdomen fuscous, cerci and legs as in the male. Length of pronotum 3 mm.; of tegmina 10 mm. Perty describes the head of this species as black, but his figure shows it to be red.

5. *P. annulicornis*, Burm. (Brazil, Bahia.)

Thyrsocera annulicornis, Burmeister, l. c. p. 500, n. 9 (1838); Brunner, l. c. p. 125, n. 16 (1865).
Pseudomops deceptura, Walker, l. c. p. 82, n. 21 (1868).

The type is at Berlin, and from a sketch of it made for me by Dr. Brauer I am of opinion that *P. deceptura*, Wlk., is synonymous; the insect is testaceous-rufous with an infuscated patch on the posterior part of the pronotum, the white band on the antennæ occupies ten joints. The species is undoubtedly very closely allied to *P. laticornis*, Perty, but as Burmeister was acquainted with that species and yet described *annulicornis* as new, it seems advisable to keep them separate. *Blatta annulicornis*, Wlk., the type of which is in the Oxford Museum, is a species of *Phyllodromia.*

6. *P. aurantiaca*, Sss. and Zhntn. (Panama.)

Thyrsocera aurantiaca, de Saussure and Zehntner, l. c. p. 32, n. 6, pl. 3, ff, 6, 7 (1893).

I have compared the type of this with the type of *P. deceptura*, Wlk., and find that the two are distinct.

7. *P. grata*, Rehn. (Costa Rica.)

Pseudomops grata, Rehn. Trans. Am. Ent. Soc. xxix, p. 260 (1903).

The species is unknown to me.

8. *P. americana*, Sss. (ARGENTINE REPUBLIC.)

Thyrsocera americana, de Saussure, Rev. Zool. (2), xxi, p. 111 (1869); Miss. Mex. Orth. p. 51 (1870).

The type is in Paris. This is another rufous species, perhaps not distinct from *P. annulicornis*, Burm.

9. *P. mimica*, Wlk. (BRAZIL, Para.)

Pseudomops mimica, Walker, l. c. p. 80, n. 17 (1868).

♀. Head black, antennæ mutilated, pronotum rufous, with a fuscous crescentic band on the hind margin. Tegmina dark fuscous, mediastinal area and a small spot at the base of the marginal field hyaline-testaceous. Abdomen black, the fifth tergum with two lateral testaceous spots; cerci mutilated; supra-anal lamina produced, quadrate. Legs dark castaneous, apices of coxæ and trochanters testaceous. Length of body 8 mm.; length of tegmina 10 mm.

Type in the British Museum.

The dark tegmina and the rufous pronotum render this a sufficiently conspicuous insect.

10. *P. cincta*, Burmeister. (MEXICO, GUATEMALA, NICARAGUA.)

Thyrsocera cincta, Burmeister, l. c. p. 499, n. 3 (1838); Brunner, l. c. p. 122, n. 9 (1865); de Saussure, Mém. Mex. Blatt. p. 50, pl. 1, f. 28 (1870); de Saussure and Zehntner, l. c. p. 32, n. 1 (1893).
Thyrsocera mexicana, de Saussure, l. c. p. 122 (1864).
Thyrsocera sallei, de Saussure, l. c. p. 123 (1864).
Pseudomops sallei, var., Walker, l. c. p. 77, n. 4 (1868).
Thyrsocera cincta, var., de Saussure, Miss. Mex. Orth. p. 51 (1870).

The species exhibits a great range of variation, the extreme forms are very different in coloration, but as de Saussure has examined a considerable series of specimens which help to bridge over the differences, I accept his conclusion that *P. sallei* is merely a rufous variety of *cincta*.

11. *P. neglecta*, n. sp. (BRAZIL, Rio Grande do Sul.)

♀. Head and mouth parts piceous; antennæ black with a testaceous band beyond the middle occupying six joints, incrassated at base and pilose. Pronotum as long as broad, anteriorly truncate, not covering the vertex of the head, posteriorly produced, obtusely angled, dark fuscous, all the margins bordered with yellow, broadest laterally. Tegmina fuscous or rufo-fuscous, mediastinal field hyaline or testaceo-hyaline, marginal field partially hyaline; seventeen to eighteen costal veins, discoidal field with six longitudinal sectors. Wings infuscated. Abdomen fuscous, segments laterally bordered with testaceous, apex rufo-fuscous; supra-anal lamina triangular, produced, sub-genital lamina ample, semi-orbicular, rufous, posteriorly margined narrowly with fuscous; cerci fuscous. Legs black, the tibial spines rufous, the coxæ margined with testaceous.

Total length 10·5 mm.; length of tegmina 8 mm.; pronotum 3 mm. × 3 mm.

Three examples labelled in Brunner's handwriting "*Thyrsocera sp. n.*" (Oxford Museum).

The species is allied to *P. cincta*, Burm., and may be distinguished from it chiefly by its smaller size, shorter tegmina, broader pronotum and by the colour of the legs. A similar example from Monte Video in the Paris Museum stands under the name *P. cincta*.

12. *Pseudomops affinis*, Burm. (SURINAM, BRAZIL, Para.)

Thyrsocera affinis, Burmeister, l. c. p. 499, n. 4 (1838); Brunner, l. c. p. 124, n. 14 (1865).
Thyrsocera hirticornis, Burmeister, l. c. p. 500, n. 10 (1838); Brunner, l. c. p. 124, n. 14 (1865).

Dr. Taschenberg of Halle having kindly lent me the type of *P. affinis* I have been able to compare it with Brunner's description and find that it agrees admirably with that account. The type of *P. hirticornis* is apparently in Brunner's collection and is considered by Brunner to be the male of *P. affinis*.

13. *Pseudomops flavipes*, Burm. (BRAZIL, Rio de Janeiro.)

Thyrsocera flavipes Burmeister, l. c. p. 499, n. 5 (1838); Brunner, l. c. p. 125, n. 16 (1865).

Pseudomops flavipes, var., Walker, l. c. p. 79, n. 10 (1868).
Pseudomops walkeri, Kirby, Ann. Mag. Nat. Hist. (7), xii, p. 273 (1903).

As shown by a drawing of the type now at Berlin this species is very closely allied to *P. affinis*, and the arrangement of colours on the pronotum is identical, however *flavipes* has flavid legs and the abdomen and tegmina appear to be paler.

14. *P. angusta*, Wlk. (SANTAREM, COLOMBIA.)

Pseudomops angusta, Walker, l. c. p. 81, n. 19 (1868).

♀. Head shining black with a round yellowish spot on the frons; clypeus yellow, labrum black; maxillary palpi luteous, apical joint black. Antennæ with the basal half incrassated, black, a white band at the base of the apical half occupying eight joints. Pronotum with the posterior border strongly produced, black, bordered all round with bright yellow, the lateral borders at one point on each side produced inwards to form two broad projections which do not meet. Tegmina ferruginous at the base, at the apex flavo-hyaline, the costal margin testaceous between the veins, the mediastinal field hyaline; a slender fuscous humeral stripe. Wings flavo-hyaline. Abdomen, cerci and legs luteous-yellow; bases of the coxæ black. Cerci long, not spatulate. Supra-anal lamina, produced, quadrate.

Total length 13 mm.; length of tegmina 10 mm.

This description is taken from a specimen in the Hope Museum, Oxford; it differs a little from the type which is in the British Museum, but is too close to be separated.

The species is allied to *P. flavipes*, Burm., but differs by the broader testaceous band on the antennæ, by the greater extent of the yellow margins of the pronotum, the black disc of the pronotum being almost divided into two by the inward projections of the yellow lateral borders; the intervenular stripes of opaque testaceous on the tegmina are variable characters.

15. *P. burri*, n. sp. (ECUADOR, Cachabi.) (Plate XIV, fig. 1.)

♀. Allied to *P. angusta*, Wlk., but smaller, prothorax not so markedly produced behind. Head orange-yellow with the vertex and frons black or entirely black with orange lines above the antennal sockets and at base of clypeus; two orange lines behind the eyes; the

antennæ with basal half incrassated, black, a luteous band occupying five joints beyond the middle. Prothorax luteous with a pyriform black central marking, the point directed backwards. Tegmina ferruginous at the base; the mediastinal field hyaline, the marginal field flavo-hyaline with intervenular streaks of opaque testaceous; apex of tegmina flavo-hyaline, the veins ferruginous. Wings flavo-hyaline. Legs, abdomen, and cerci bright luteous, the coxæ at their extreme bases outwardly tipped with black and with pale borders. Cerci elongate. Supra-anal lamina triangular, produced.

Total length 12 mm.; length of tegmina 10 mm.

Three examples (*W. F. H. Rosenberg* coll., Dec. 1896). (Oxford Museum.)

Named after Mr. Malcolm Burr to whose generosity the Oxford Museum owes a magnificent collection of exotic Orthoptera.

The species differs from *P. angusta*, Wlk., in the following points:—The less extent of the white band on the antennæ, the different shape of the black disc of the pronotum, the testaceous stripes on the tegmina.

16. *P. discicollis*, Burm. (Mexico.) (Plate, XIV, fig. 2.)

Blatta discicollis, Burmeister, l. c. p. 1012 (1838); de Saussure, Mém. Mex. Blatt. p. 114 (1864).
Thyrsocera discicollis, Brunner, l. c. p. 123, n. 10 (1865).
Thyrsocera laticornis, var., de Saussure and Zehntner. Biol. Centr.-Amer. Orth. i, p. 32, n. 2 (1893).

This is a very well-marked species, and the most robust of the genus. The type, of which I have a drawing, is at Berlin; another example is in the collection of Central American Orthoptera in the British Museum, and stands under the name of *P. laticornis*, Perty; a third, from which the following description is drawn up, is in the Oxford Museum.

♀. Head and mouth parts black, antennæ mutilated (in the type, very long, black at base with a testaceous annulus occupying nineteen joints about the middle of total length, beyond the middle fuscous). Pronotum almost orbicular, but truncate in front, not covering the vertex and produced behind, disc piceous with broad lateral borders of orange-yellow, the posterior border margined with a fine yellow line; the black of the disc which just fails to meet the yellow anterior margin is narrowed anteriorly. Tegmina

dark fuscous, mediastinal field at apex testaceous, fifteen costal veins, discoidal field with nine longitudinal sectors, wings fuscous. Abdomen, cerci and legs dark fuscous, coxæ outwardly margined with whitish. Supra-anal lamina quadrately produced.

Total length 19·5 mm.; length of tegmina 15 mm.; pronotum 5 mm. × 6 mm.

17. *P. gueriniana*, Sss. (MEXICO.)

Thyrsocera gueriniana, de Saussure, Rev. Zool. (2) xiv, p. 168 (1862); Mém. Mex. Blatt. p. 124 (1864); Miss. Mex. Orth. p. 50 (1870); Brunner, l. c. p. 126, n. 19 (1865).

The type is in the Paris Museum.

18. *P. obscura*, Sss. (BOLIVIA, SANTA CRUZ.)

Thyrsocera obscura, de Saussure, Miss. Mex. Orth. p. 52 (1870).

The type is in the Paris Museum.

19. *P. magna*, n. sp. (ECUADOR, Paramba.)

♂. Entirely black, except a testaceous band on the antennæ beyond the basal incrassated portion and the testaceous terminal three joints of the cerci which are not spatulate; an orange patch in the middle of the ventral surface of the abdomen. The borders of the coxæ are not white, and the mediastinal area of the tegmina is not hyaline. Body depressed. Posterior border of prothorax obtusely rounded. ♀. Like the male but without the orange patch on the abdomen; the supra-anal lamina is triangular, its apex slightly incised.

	Total length.	Length of body.	Length of tegmina.
♂.	18 mm.	15·6 mm.	14
♀.	18 mm.	14 mm.	13·5

One male and two females (*W. F. H. Rosenberg* coll. February and May 1897). (Oxford Museum.)

20. *P. albostriata*, n. sp. (ECUADOR, Cachabi.)

♀. Black; antennæ beyond the penicillation, with a testaceous band occupying nine joints. Pronotum quite black except for a very narrow border of testaceous, not occurring on the front margin; the

pronotum is strongly produced backwards. Tegmina with the mediastinal area, except at the base, and eight oblique costal streaks, testaceous. The sub-genital lamina and the discs of the sterna of the three preceding segments bright rufous. Coxæ white-edged. Cerci black, not spatulate.

Total length 12 mm. ; length of tegmina 10 mm.

One example (*W. F. H. Rosenberg* coll. Nov. 1896). (Oxford Museum.)

The species appears to be quite distinct from all the other black species of this genus; it approaches *P. luctuosa*, Sss., more closely than any other.

21. *P. bicolor*, n. sp. (ECUADOR, Paramba.) (Plate XVI, figs. 12, 12*a*; and Plate XIV, fig. 7.)

♂. Head and antennæ (mutilated) black. Pronotum orange-red with some very obscure darker markings. Tegmina fuscous with the costal margin narrowly fulvous for two-thirds of its length. Wings fusco-hyaline. Abdomen bright luteous except the last five terga and the sub-genital lamina which are black; on the 6th tergum is a prominent mamillary tubercle covered with an orange pubescence and with a small opening on each side. Cerci black with the two terminal joints white. Coxæ and trochanters bright luteous; the 2nd and 3rd pairs of femora bright luteous with the apices fuscous; the 1st pair of femora, the tibiæ and tarsi fuscous; the tibial spines rufous.

Length of body 13·5 mm. ; length of tegmina 14 mm.

One example (*W. F. H. Rosenberg* coll. Mar. 1897).

This species is quite distinct from all the known forms. The opening of the so-called repugnatorial glands on the 6th abdominal segment is remarkable and unlike any other known to me. The 7th abdominal tergum is almost entirely covered by the 6th tergum, the posterior border of which is incised.

II. CERCI spatulate.

22. *P. femoralis*, Wlk. (BRAZIL, Rio de Janeiro.)

Pseudomops femoralis, Walker, l. c. p. 81, n. 18 (1868).
Thyrsocera crinicornis, Brunner, l. c. p. 126, n. 21 (1865).

Brunner's description of *P. crinicornis* applies with great exactitude to this species, four examples of which

are in the Hope Museum, Oxford; one example was sent to Berlin for comparison with Burmeister's type of *crinicornis* and was found to be quite distinct; nor was it found to agree with the other species described by Burmeister in that collection.

23. *P. brunneri*, Sss. (SURINAM.)

Thyrsocera brunneri, de Saussure, Rev. Zool. (2) xxi, p. 111 (1869); Miss. Mex. Orth. p. 49 (1870).
Thyrsocera crinicornis, var. *fulva*, Brunner, l. c. p. 127 (1865).

I have examined the type at Paris, and in my opinion the species is distinct from *P. femoralis*, Wlk.

24. *P. crinicornis*, Burm. (BRAZIL, Para.)

Thyrsocera crinicornis, Burmeister, l. c. p. 499, n. 2 (1838); de Saussure, Rev. Zool. (2) xxi, p. 111 (1869); Miss. Mex. Orth. p. 48 (1870); de Saussure and Zehntner, l. c. p. 33, n. 7 (1893).
Pseudomops affinis, Walker, l. c. p. 79, n. 9 (1868).

De Saussure has identified this species correctly, and his description of it should render its determination easy; a drawing of an example in the Hope Museum, Oxford, was sent to Berlin, and found to correspond closely with Burmeister's type.

25. *P. luctuosa*, Sss. (SURINAM.)

Thyrsocera luctuosa, de Saussure, Rev. Zool. (2) xx, p. 99 (1868); Miss. Mex. Orth. p. 48, pl. 1. ff. 27, 27*a* (1870).

The species is quite distinct from *P. crinicornis*, Burm.

26. *P. tristicula*, Stål. (BRAZIL, Rio de Janeiro.)

Pseudomops tristicula, Stål. Freg. Eugenie's Resa, Zool. v. p. 310 (1858).
Thyrsocera tristicula, Brunner, l. c. p. 125, n. 17 (1865).

An entirely black species with a testaceous vitta on each side of the abdomen beneath.

27. *P. puiggarii,* Bol. (Brazil, San Pablo.)

Thyrsocera puiggarii, Bolivar, An. Soc. Españ. x, p. 354 (1881).

This is possibly conspecific with *P. tristicula,* Stål., but the description of the latter is so inadequate that certainty on this point is not possible without comparison of types.

28. *P. nigrita,* Sss. (Brazil.)

Thyrsocera nigrita, de Saussure, Rev. Zool. (2) xxi, p. 111 (1869); Miss. Mex. Orth. p. 52 (1870).

This species was described from a specimen lacking the abdomen and antennæ, and on the strength of the different colour of the legs was held to be different from *P. tristicula,* Stål. A perfect example of what appears to be undoubtedly this species was sent to me by Dr. Taschenberg of Halle and shows that the species is quite distinct from *tristicula,* the abdomen being orange-red above and below. In the male the supra-anal lamina is triangularly produced and deeply notched, the sub-genital lamina is ample and orbicular, bearing two short acuminate styles; the cerci are orange and broadly spatulate; the ante-penultimate tergum has the posterior margin notched in the middle, whilst the preceding tergum is very broadly and deeply emarginate, exposing nearly the whole of the following tergum.

29. *P. melana,* Wlk. (Brazil.)

Pseudomops melana, Walker, l. c. p. 80, n. 16 (1868).

Distinguished by a luteous band on the abdomen above.

30. *P. simulans,* Stål. (Brazil.)

Pseudomops simulans, Stål. l. c. p. 310 (1858).
Thyrsocera simulans, Brunner, l. c. p. 124, n. 13 (1865).

This species, owing to the inadequacy of the description, cannot be recognized with certainty; it may not even enter into the section of the genus with spatulate cerci.

Pseudomops melandryoides, Wlk. (l. c. p. 84, 1868) is a species of *Phyllodromia.*

TABLE OF SPECIES INCLUDED IN THE GENUS *PSEUDOMOPS*, Serv.

A. Cerci not spatulate.

1. Pronotum not unicolorous, margins paler than disc.
  - 2. Ground colour of pronotum some shade of rufous.
    - 3. Lateral pale margins of pronotum inwardly produced . . . . *intercepta*, Burm.
    - 3′. Lateral pale margins of pronotum not inwardly produced.
      - 4. Disc of pronotum with definite darker markings.
        - 5. Two dark spots on the disc of the pronotum . . . . . *oblongata*, L.
        - 5′. A horseshoe-shaped mark on the disc of the pronotum. *inclusa*, Wlk.
      - 4′. Disc of pronotum without definite darker markings.
        - 5. General colour of tegmina rufous.
          - 6. Fusco-rufous . . . . . *laticornis*, Burm.
          - 6′. Testaceo-rufous . . . . *annulicornis*, Burm., *americana*, Sss.
        - 5′. General colour of tegmina orange.
          - 6. Tegmina with apex only infuscated . . . . . *aurantiaca*, Sss. and Zhnt.
          - 6′. Tegmina with apical three-fifths infuscated . . . *grata*, Rehn.
        - 5″. General colour of tegmina fuscous . . . . *mimica*, Wlk.
  - 2′. Ground colour of pronotum fuscous.
    - 3. Lateral yellow borders of pronotum not broad.
      - 4. Lateral yellow borders not inwardly produced.
        - 5. Pronotum longer than broad *cincta*, Burm.
        - 5′ Pronotum not longer than broad . . . . *neglecta*, mihi.

4′. Lateral yellow borders inwardly produced.
5. Legs not entirely yellow . . *affinis*, Burm.
5′. Legs entirely yellow.
6. Lateral yellow borders of pronotum strongly produced inwards . . . . *angusta*, Wlk.
6′. Lateral yellow borders of pronotum less strongly produced inwards . . . *flavipes*, Burm.
3′. Lateral yellow borders of pronotum broad.
4. Yellow border of pronotum nearly equally broad throughout . . . . *gueriniana*, Sss.
4′. Yellow border of pronotum narrowed anteriorly and posteriorly.
5. Of large size . . . . *discicollis*, Burm.
5′. Smaller . . . . *burri*, mihi.
1′. Pronotum unicolorous.
2. Pronotum red . . . . *bicolor*, mihi.
2′. Pronotum black or fuscous.
3. Abdomen not orange in the male.
4. Tegmina without white streaks *obscura*, Sss.
4′. Tegmina with white streaks . *albostriata*, mihi.
3′. Abdomen orange in the male . *magna*, mihi.

B. Cerci spatulate.

1. Pronotum with broad yellow borders.
2. Tegmina fuscous . . . . *femoralis*, Wlk.
2′. Tegmina fulvous . . . . *brunneri*, Sss.
1. Pronotum with narrow yellow borders or none.
2. Abdomen orange . . . . *nigrita*, Sss.
2′. Abdomen black.
3. Abdomen entirely black.
4. No white lines on the tegmina . *crinicornis*, Burm.
4. Tegmina with white lines . . *luctuosa*, Sss.
3′. Abdomen not entirely black.
4. Abdomen rufous at base . . *puiggari*, Bol.
4′. Abdomen not rufous at base.

5. Abdomen with transverse testaceous band above . . *melana*, Wlk.
5′. Abdomen with longitudinal vittæ below . . . . . . *tristicula*, Stål.

III. Some new *Blattidæ* from Sarawak, Borneo, in the Hope Department, Oxford University Museum.

Mr. J. Hewitt, Curator of the Sarawak Museum, recently forwarded to me for determination a small collection of cockroaches; thirteen of the species appear to be new to science and are described below. The rediscovery of the species described by Serville as *Blatta decorata* is of some interest. The numbers attached by Mr. Hewitt to his specimens are quoted in square brackets.

Genus Ischnoptera, Burm.

Ischnoptera excavata, n. sp. (Plate XVI, fig. 11.)

♂. Fulvo-ferruginous. Eyes closer together than the antennal sockets. Pronotum trapezoidal, sides deflexed, posterior margin obtusely angled. Tegmina with the radial vein bifurcated near base, seventeen costal veins, seven discoidal sectors. Wings hyaline, marginal field and veins ferruginous, mediastinal vein with five branches, radial vein bifurcated, eleven costal veins, ulnar vein sending four rami to apex, two to dividing vein, first axillary vein tri-ramose. Anterior femora with anterior margin beneath strongly spined, the proximal spines longer than the distal; all the femora with apical spines on both margins and with genicular spines. Supra-anal lamina profoundly modified, proximally it is deeply depressed with a median elevated carina, so that two wide pits are formed which are directed forwards beneath the preceding tergum, posterior margin of the lamina rounded, slightly emarginate. Sub-genital lamina of normal shape, but without styles. Cerci moderate.

Total length 21 mm.; length of tegmina 17 mm.

Kuching (March 1899). One example [No. 32].

I know of no other species of Blattid in which so extensive a modification of the supra-anal lamina occurs;

the opening of the so-called "repugnatorial" glands in many species leads to modifications of the penultimate or antepenultimate terga, but not to that of the supra-anal lamina.

Ischnoptera montis, n. sp. (Plate XVI, fig. 10.)

♂. Head castaneous, antennæ rufo-fuscous. Pronotum trapezoidal, castaneous, sides deflexed. Tegmina testaceous-hyaline, thirteen to fourteen costal veins, anterior ulnar vein quadri-ramose, posterior ulnar tri-ramose. Wings hyaline, mediastinal vein long with two branches, radial vein unbranched, eight costal veins, the four proximal ones incrassated, median vein simple, ulnar vein giving off five veins to apex and three to the dividing vein. Abdomen castaneous, the first few segments paler; the first segment above with a median deep depression, the anterior wall of which is fimbriated with rufous hairs that appear to conceal a minute orifice, from the posterior wall projects a blunt tooth covered with a rufous pubescence. The middle of the seventh segment is depressed and the middle of the posterior margin of the sixth segment is slightly elevated, forming a wide-mouthed tube in which can be seen numerous hairs. Supra-anal lamina trapezoidal; subgenital lamina asymmetrical with two acuminate styles asymmetrically placed, the right being almost median, the left lateral. Cerci castaneous, mutilated. Legs rufo-castaneous, front femora with several spines along the anterior margin beneath, the distal members of the series shorter than the proximal.

Length of body 13 mm.; length of tegmina 14 mm.

MT. MATANG, 3000 feet. One example [No. 21].

The secondary sexual characters of the Oriental species of *Ischnoptera* appear to be most diverse in character, and a careful anatomical study of the structures whose presence is revealed by openings to the exterior and modifications of the overlying terga is much to be desired. The modification of the first abdominal tergum described above appears to be unusual amongst the Blattidæ.

Genus PSEUDOPHYLLODROMIA, Br.

Pseudophyllodromia pulcherrima, n. sp. (Plate XIV, fig. 3.)

♂. and ♀. Piceous. Head large and broad projecting beyond the pronotum, with a narrow golden line between the eyes; antennæ fine, setaceous, longer than the body. Pronotum trapezoidal, sides

not deflexed, bordered all round with a narrow golden line, the line is marginal on the anterior and posterior margins of the prothorax but submarginal on the lateral margins. Tegmina with the mediastinal area, a horseshoe-shaped vitta astride the radial vein near its base, and an elongate vitta in the apical part of the marginal field, golden (faded to white in dried specimens). The surface of the tegmina is somewhat rugulose; marginal field broad, nine costal veins, ulnar vein with nine oblique branches, no division of the vein into an anterior and posterior trunk, anal vein strongly impressed. Wings infuscated, especially strongly in marginal field and at apex, a clear hyaline spot in marginal field; nine somewhat irregular costal veins, ulnar vein with four rami, no apical triangle, first axillary tri-ramose. Abdomen piceous; supra-anal lamina of male transverse, of female slightly produced, emarginate; abdomen beneath piceous, the centre of the last few segments rufous, sub-genital lamina of the male short, transverse, of the female large, ample; cerci moderate, piceous, apical three joints golden above. Legs piceous, apices of coxæ and trochanters golden, tarsi and tibial spines rufous. Front femora unarmed beneath, mid-femora with two spines on anterior margin, three on posterior margin, hind femora with two on anterior margin and four on posterior margin, all the femora with apical spines on both margins and with genicular spines. The genital apparatus of the male appears to be very complicated. The ootheca is almost cylindrical, longitudinally finely striated, with a longitudinal serrulate crest, it is carried by the female with the crest uppermost and the contained eggs vertically disposed. The larvæ have the anterior and lateral margins of the pronotum, the lateral margins of the meso- and metanotum, two spots on the metanotum and on the fourth and fifth abdominal terga, golden.

Total length 10 mm.; length of tegmina 6 mm.

KUCHING. Several examples [No. 12].

This little cockroach is abundant in decayed wood; in general appearance it is unlike the South American species of the genus, but I can find no character of sufficient importance to entitle it to separate generic rank, unless the undivided trunk of the ulnar vein of the tegmina can be so regarded. An allied species occurs in Penang, but the unique example before me is in such bad condition that I prefer to await additional material before describing it. *Phyllodromia laticeps*, Wlk., and *P. laticaput*, Br., should also be referred to the genus *Pseudophyllodromia*.

Genus Allacta, Sss. and Zhntn.

Allacta parva, n. sp.

♂. Head and antennæ testaceous, two pyriform vittæ on the frons castaneous. Pronotum transversely elliptical, castaneous, with a triangular testaceous mark on the centre of the anterior margin. Tegmina castaneous, mediastinal area and a transverse spot just before the middle of the tegmen continuous with it, hyaline; ten costal veins, anterior ulnar vein with three longitudinal rami, posterior trunk simple. Wings hyaline, six costal veins, the third, fifth and sixth bifurcate, their extremities swollen; radial vein bifurcate, ulnar vein with four branches. Femora moderately armed. Supra-anal lamina transverse, sub-genital lamina orbicular, with two styles. Cerci elongate.

Total length 8 mm.; length of tegmina 6 mm.

Kuching. Two examples [No. 23].

Genus Epilampra, Burm.

Epilampra saravacensis, n. sp.

♀. Allied to *E. inclarata*, Wlk., but larger, the ocelliform spots on the tegmina smaller and less numerous, the part of the right tegmen overlapped by the left not marbled or ocellated, marginal field of wings not so strongly marked with rufescent.

Pale fulvous; head with darker points densely arranged; pronotum not covering the vertex of the head, its posterior margin obtusely angled, covered with densely arranged fuscous and rufous points, but not punctate. Tegmina with a few small white ocelliform spots, except on that part of the right tegmen overlapped by the left, which is uniform fulvous. Wings with apex slightly fulvous. Abdomen flavo-testaceous above, rufous below. Front femora with six stout spines on the middle of anterior margin beneath, three on posterior margin in distal half, mid- and hind-femora with three spines on anterior, four on posterior margin; formula of apical spines $\frac{2}{1}$, $\frac{1}{1}$, $\frac{1}{0}$; genicular spines on mid- and hind-femora, none on the front pair; pulvilli margined with spines, the second joint with spines beneath in addition.

Total length 56 mm.; length of body 43 mm.; length of tegmina 48 mm.

Lingga, Batang Lupar River. One example [No. 15].

Epilampra goliath, n. sp.

♂. Allied to *E. moloch*, Rehn., from Siam, of the same dark vinaceous brown above and of the same elongate ovate shape. It differs as follows: Head not projecting beyond the pronotum, vertex and a broad stripe extending to the clypeus fuscous, the front of the head and antennæ testaceous; pronotum with two crescentic impressions on the disc. Marginal field of tegmina very broad, almost equalling half the total breadth, mediastinal vein with five branches. Wings with anterior part suffused with rufous, strongest at apex. Subgenital lamina broad, asymmetrical with two flattened styles. Abdomen flavo-testaceous above, rufo-fuscous below with paler margins, a dark stigma on each side of each segment. Front femora with five spines on median part of anterior margin, three on posterior margin, mid- and hind-femora with three to five spines on each margin, all the femora with genicular spines, formula of apical spines $\frac{1}{1}$, $\frac{1}{1}$, $\frac{1}{0}$; pulvilli of posterior tarsi not margined with spines.

Total length 58 mm.; length of body 50 mm.; length of tegmina 50 mm.

Mt. Matang, 3000 feet. One example [No. 14]; N. Borneo opposite Labuan. One example.

If the admirably detailed description of *E. moloch*, Rehn (Proc. U.S. Nat. Mus., xxvii, p. 550, 1904), be compared with the foregoing description it will readily be seen in what features the two insects differ; I have omitted descriptions of those features wherein the two species resemble each other. Both species bear a marked resemblance to *Molytria badia*, Br.

Epilampra miranda, n. sp.

♂. Allied to the preceding species. Fulvo-testaceous. Head with very convex front, eyes more remote than ocellar spots, vertex with three longitudinal stripes. Pronotum shaped as in *E. moloch*, Rehn, and *E. goliath*, mihi, but somewhat more cucullate, only just covering the vertex of the head, with scattered punctures and with two crescentic impressions on the disc. Tegmina with marginal field equal to half the total breadth, mediastinal vein with seven branches; speckled with paler spots, radial vein at base fuscous. Wings hyaline, veins flavo-testaceous. Supra-anal lamina bilobate, not extending beyond the sub-genital lamina which is quadrate and slightly asymmetrical (styles mutilated); cerci moderate, acuminate; ventral segments with a black stigma on each side. Front femora with

seven spines on anterior margin beneath, mid- and hind-femora with three to four spines on anterior margin, two on posterior margin; formula of apical spines $\frac{2}{1}$, $\frac{1}{1}$, $\frac{1}{0}$, no genicular spine on front femora. Posterior metatarsus barely equal in length to remaining joints, which are not spined beneath, pulvilli not margined with spines.

Total length, 55 mm.; length of body, 44 mm.; length of tegmina, 42 mm.; pronotum, 18 mm. × 11 mm.

MT. PENRISSEN, 3500 feet (*R. Shelford coll.*). One example [No. 16].

Epilampra flavomarginata, n. sp.

♂ and ♀. Rufous. Head testaceous with minute rufous points, antennæ fuscous except at base. Pronotum not covering the vertex, sides deflexed, posterior margin obtusely angled, covered with small confluent dots darker than the ground-colour, except on the anterior and posterior margins which are flavo-testaceous. Tegmina with mediastinal area flavo-testaceous, the rest rufous with fine yellow streaks on the veins, the right tegmen where covered by the left is infuscated; branching of mediastinal vein very obscure. Wings with the marginal field luteous, the apex and veins infuscated. Abdomen flavo-testaceous. Supra-anal lamina bilobate, strongly produced in the female; sub-genital lamina in the male sub-quadrate, asymmetrical, in the female ample, semi-orbicular. Front femora with three to four spines on the proximal half of the anterior margin beneath, with close-set minute spines in the distal half, mid- and hind-femora with four to five spines on anterior margin, three on posterior margin, apical spines on both margins on all the femora, all the genicular spines present. Posterior metatarsus much longer than succeeding joints, second joint spinose beneath, pulvilli margined with spines.

Total length, 21 mm.; length of body, 17 mm.; length of tegmina, 17 mm.

KUCHING; several examples [No. 17].

This species falls into the same group that includes *E. papua*, Sss., *E. lævicollis*, Sss., *E. puncticollis*, Wlk., *E. plena*, Wlk., etc. Its coloration alone ought to render it easy of recognition.

Genus HOMALOSILPHA, Stål.

Homalosilpha decorata, Serv. (Plate XIV, fig. 8.)

Blatta decorata, Serville, Ins. Orth. p. 99 (1839).

This species of unknown habitat has been ignored in

the lists of Blattidæ described by earlier authors; neither Brunner nor Kirby mention it. The type specimen from the Marchal collection is in the Hope Museum, Oxford, and from an examination of it I am able to place it without a doubt in the genus *Homalosilpha.* An identical example from Mt. Penrissen, Sarawak [No. 28] gives the habitat of this species that has for so long been unrecognized. It may be mentioned that another of Serville's types of Blattidæ, viz. *Blatta alcarazzas,* is also in the Oxford Museum.

Genus Miroblatta, nov.

Head covered by the pronotum, eyes closer together than the antennal sockets; antennæ very long, third joint twice as long as second. Pronotum longer than broad, anterior border arcuate, posterior border truncate, exposing the scutellum; markedly cucullate and narrowed anteriorly, anterior and lateral margins reflected, disc with symmetrically disposed elevated ridges. Tegmina broad, oval, barely reaching extremity of abdomen, overlapping considerably, apex obtusely rounded; corneous, densely reticulated, venation obscured, no anal vein or anal field, radial vein strongly elevated at base, mediastinal field on under surface elevated, keeled, space between mediastinal and radial veins broad, inflexed, forming with mediastinal field an epipleuron, the outer margin of which is the anterior margin of the tegmen, the inner margin formed by the mediastinal vein. Wings broadly ovate, of same length as tegmina, coriaceous, anterior part nearly twice as broad as posterior part, the outer margin deeply indented at the point of division between the two parts, the wing appearing bilobate; mediastinal and radial veins fused, their base elevated forming a prominent ridge, six ramose branches given off to apex and outer margin, ulnar vein reduced with three ramose branches only, numerous transverse venules between all the veins; posterior part of wing not folding in fan-like manner but merely doubling under anterior part. Supra-anal lamina of male broadly transverse, slightly emarginate. Subgenital lamina of male subquadrate, styles minute. Cerci long, very sharply pointed. Legs long, slender; femora unarmed beneath; spines on posterior tibiæ in two rows. Posterior tarsi with metatarsus longer than remaining joints, no spines beneath, pulvilli large, the second occupying whole length of joint. Female not known, probably apterous.

The affinities of this highly remarkable genus appear to

be with *Archiblatta*, Vollenh., as shown by the unarmed femora and the structure of the tarsi; the form of the "epipleuron" is very different, in *Archiblatta* this is formed by a simple deflexion of the anterior part of the tegmen, whereas in *Miroblatta* the area between the mediastinal and radial veins is deflexed, but the mediastinal field itself is in the same plane as the disc of the tegmen, forming in repose a sort of flange; I know of no parallel modification of the tegmina in other Blattidæ. The method of wing-folding in *Miroblatta* is met with again only amongst the Corydiinæ.

Miroblatta petrophila, sp. n. (Plate XIV, figs. 4, 4*a*.)

♂. Elongate ovate; dark castaneous. Head fuscous, front concave, lower face rugose, clypeus flavo-testaceous, mouth parts castaneous; antennæ longer than total length of body, a broad white annulus before the middle, occupying twenty-one joints. Pronotum castaneous, disc with strong elevated ridges in the form of a horseshoe, giving off anteriorly two short diverging branches and laterally two backwardly directed branches which are less strongly marked, a median carina on the anterior cucullate part of the pronotum; area between the limbs of the horseshoe rugose, ridges and adjacent parts black, a pair of orange spots on each side of the anterior carina and another pair on each side of the limbs of the horseshoe-shaped ridge; scattered about the surface of the pronotum are numerous small tubercles bearing erect setæ. Tegmina castaneous, the radial vein black. Wings flavo-hyaline, marginal field and apex suffused with flavo-castaneous. Abdomen dark castaneous, paler at the base above. Legs dark castaneous, apices of femora flavo-castaneous; formula of apical spines $\frac{2}{1}$, $\frac{1}{1}$, $\frac{1}{1}$, no genicular spines on anterior femora.

Total length 40 mm.; length of tegmina 26 mm.; pronotum 13 mm. × 16 mm.

Mt. Santubong, 2500 feet, amongst rocks. One example.

About half-a-dozen specimens of this cockroach were captured by a native collector in August 1900; he stated that they ran with great activity and that they were incapable of flight.

Genus Corydia, Serv.

Corydia cærulea, n. sp.

♂. Brilliant blue with metallic reflections. Head, pronotum and anterior margins of tegmina and wings pubescent, antennæ fuscous,

moniliform. Pronotum transversely elliptic, punctate with two deep impressions on the disc, humeral angles well marked. Tegmina blue, with purplish reflections and some obscure orange maculæ on the disc, an orange streak on the margin of the tegmen just beyond the mediastinal field; the right tegmen where covered by the left reddish-purple. Wings hyaline, marginal field infuscated, with purplish reflections, four bifurcated costal veins, ulnar vein with seven rami. Meso- and metanotum purple. Abdomen orange, the last two segments blue. Supra-anal lamina transverse, widely emarginate; sub-genital lamina quadrate with acuminate and pubescent styles. Cerci stout, fuscous. Legs dark blue, tarsi fuscous.

Total length, 13·5 mm.; length of tegmina 10 mm.

MT. MATANG, 3000 feet (*Shelford coll.*). One example [No. 9].

The species appears to be most closely allied to *C. dasytoides*, Wlk.

Genus AREOLARIA, Br.

Areolaria signata, n. sp.

♂ and ♀. Head black, vertex with a testaceous patch on which occur two short black lines, maxillary palps testaceous, antennæ black, incrassated in the basal half and plumose, the apical half with sixteen joints testaceous and the terminal three joints fuscous. Pronotum almost quadrangular, broader than long, sides deflexed slightly, disc closely punctate, black with a central testaceous vitta incompletely divided longitudinally, posterior margin narrowly testaceous, lateral margins testaceous-hyaline. Tegmina corneous, mediastinal field hyaline, the remainder griseo-testaceous with a broad fuscous stripe running along the radial vein then turning at right angles to cross the apex of the anal field and to meet its fellow of the opposite tegmen, left tegmen with a fuscous stripe on the sutural margin, the portion of the right tegmen that is overlapped by the left is black and shining; all the veins marked by lines of punctures. Scutellum prominent, black, punctate. Wings hyaline, marginal field infuscated, thirteen costal veins, strongly incrassated and connected by transverse venulæ, median vein simple, medio-discal area crossed by nine transverse venulæ, ulnar vein tri-ramose, first axillary vein quadri-ramose, triangular apical field very large, unequally divided by a longitudinal vein. Abdomen of male flavid above, fuscous below, supra-anal lamina, shortly produced, triangular, sub-genital lamina narrower, apex deeply and triangularly cleft with two short styles, cerci flavid. Abdomen of female broader fuscous

above and below, supra-anal lamina more produced with a median carina, sub-genital lamina very large, its surface with shallow confluent punctures. Front legs and all the coxæ fuscous, all the tarsi, the mid and posterior tibiæ testaceous with the bases fuscous, the mid and posterior femora testaceous at base, fuscous at apex.

Total length, 9 mm.; length of tegmina 6·5 mm.

KUCHING. Four examples [No. 7].

The incrassated and plumose antennæ in both sexes will serve to distinguish this species from those already described.

Genus HOMOPTEROIDEA, nov.

Head as in *Latindia*, Stål, antennæ elongate. Pronotum elliptic, sides not deflexed, with arcuate sulci, with a sparse erect pubescence. Tegmina membranous, slightly exceeding the abdomen in length, or much longer, venation irregular, apical part of discoidal area reticulate, no oblique vein. Wings as long as tegmina in both sexes. Supra-anal lamina produced, triangular, sub-genital lamina in the female deeply cleft. Cerci elongate. Femora unarmed beneath; tibiæ sparsely spined, spines in two rows; tarsi without arolia.

The genus differs from *Latindia*, Stål, by the absence of an oblique vein in the tegmina, from *Paralatindia*, Sss., by the presence of alar organs in both sexes, from *Ipisoma*, Bol., by the equally long tegmina and wings, from *Hemilatindia*, Sss., by the pronotum without deflexed sides and by the entirely membranous character of the tegmina.

There are four species in the Oxford Museum, all from the Oriental region, but the specimens are in bad condition. The insects which in life appear very like small Homoptera of the family Fulgoridæ (e.g. *Leusaba*, *Stacota*, *Epora*) are extremely fragile and it is a matter of difficulty to capture perfect specimens.

Homopteroidea nigra, n. sp. (Plate XVI, figs. 13, 14.)

♀. Head black, antennæ fuscous, clypeus with an erect pubescence. Pronotum almost orbicular, margined all round, a few erect hairs on the anterior and lateral margins, disc irregular with two converging sulci posteriorly, black, lateral margins dark castaneous. Tegmina castaneous, radial vein giving off four costal veins, three longitudinal sectors in discoidal field, apex of tegmina reticulate, anal vein angled, axillary veins reduced, reticulated. Wings infuscated, four costal veins, ulnar vein tri-ramose, apex of wing reticulated.

Abdomen fusco-castaneous; supra-anal lamina large, produced, margin slightly reflected, emarginate in the middle and with a stiff erect pubescence, sub-genital smaller than the supra-anal lamina, compressed laterally and deeply cleft; cerci mutilated. Legs fusco-castaneous, tarsi paler, front femora with apical spine on anterior border beneath, no genicular spine, mid-femora with two apical spines and a genicular spine, hind femora missing ; tarsi without arolia.

Length of body 7 mm. ; length of tegmina 3 mm.

KUCHING. One example [No. 26]. An example of this species from Sumatra is in the Paris Museum.

Genus PARANAUPHŒTA, Br.

Paranauphœta atra, n. sp.

♂ and ♀. Entirely black, shining, except the apical third of the antennæ which is testaceous, and the labrum which is flavo-testaceous. Pronotum marked with irregular depressions. Tegmina with radial vein ramose, fourteeen to fifteen costal veins, their basal halves obsolescent, anterior ulnar vein bifurcate, posterior ulnar multiramose, anal vein not reaching the middle of the sutural margin. Wings infuscated, radial vein irregular, costal veins obsolete, ulnar vein sending many branches to the dividing vein, an inconspicuous apical triangle. Supra-anal lamina in both sexes large, the cerci barely exceeding it, its posterior margin in the female slightly emarginate; sub-genital lamina in male large, asymmetrical with prominent acuminate styles, in the female ample.

Total length, 27 mm. ; length of tegmina, 21 mm.

KUCHING. A long series [No. 6].

[*Paranauphœta affinis,* n. sp.

♀. Allied to *P. basalis,* Serv., but with no yellow band on the head between the eyes ; abdomen beneath with no yellow spots, the last three segments of the abdomen above with very small yellow spots ; the supra-anal lamina entirely black. Tegmina and wings variable in length, in one example not extending beyond the middle of the sixth abdominal segment, in no case attaining the extremity of the abdomen.

Total length 22 mm. ; length of tegmina 13 mm. to 15 mm.

BHUTAN. Four examples (Paris Museum).]

IV. The Type of *Epilampra brasiliensis*, Fab.

Fabricius' description in his "Systema Entomologiæ," 1775, p. 272, of this species is as follows:—

"B. pallida, abdomine atro.

"Habitat in Brasilia. *Mus. Dom. Banks.*

"Paulo major *B. lapponica.* Tota pallida, abdomine subtus atro. Antennæ fuscæ."

So brief a description of a member of a genus including numbers of cryptically-coloured species, renders its determination by subsequent authors almost impossible. The synonymy of the species according to Brunner (Nouv. Syst. d. Blatt. 1865, p. 159) is:—

Epilampra brasiliensis, Burm. Handb. ii, p. 505 (1838).

Blatta maculicollis, Serv., Ins. Orth. p. 92 (1839).

? *Blatta grisea*, De Geer, Mém. Ins. iii, p. 570, n. 7, pl. 44, f. 9 (1773).

? *Blatta grisea*, Oliv. Enc. Méth. T. iv, p. 319, n. 35.

? *Phyllodromia burmeisteri*, Guér. Ile de Cuba, Anim. Art. p. 345 (1857).

None of these species can be recognized with certainty, since the descriptions of them are inadequate and the types of some are missing. The Hope Museum at Oxford contains some drawings made by the late Professor Westwood of several of Serville's types, amongst others the type of *Blatta maculicollis*, and on comparing this with the Fabrician type of *Blatta brasiliensis* in the Banksian cabinet at the British Museum I have come to the conclusion that the two species are distinct. Brunner's own description does not apply to the Fabrician type, nor to the drawing of *maculicollis*, and I would therefore suggest the name of *Epilampra burmeisteri*, Guér., for this species. *Epilampra burmeisteri* has been well described also by de Saussure (Mém. Mex. Blatt., p. 131), though I am by no means certain if this author had the opportunity of seeing Guérin's type which came from Cuba. Examples in the Oxford Museum from Jamaica, Guiana and Brazil appear to be identical with each other and they correspond well with Brunner's and de Saussure's descriptions. It remains then only to give a detailed description of the Fabrician type.

On referring to the Banksian cabinet I found two specimens belonging to distinct species under the name *Blatta brasiliensis*; one measured in total length 18 mm., and had the abdomen fuscous beneath, the other measured 25·1 mm., and had the abdomen beneath rufous with pale disc. The former specimen corresponds the more closely to the diagnosis of Fabricius and may be selected as the type of the species; the following is a description of it:—

♂. Dull testaceous. Head with a few small brown maculæ on the front and face, palpi pallid; (antennæ broken). Pronotum broadly transverse not covering the vertex, lateral margins broadly hyaline, disc testaceous, unspotted. Tegmina testaceous hyaline, unspotted; mediastinal vein unbranched, radial vein with eight costal branches, the two last bifurcate, apex of radial vein ramose and not reaching end of tegmina, anterior ulnar vein bifurcate, the branches becoming ramose, posterior ulnar vein simple, anal sulcus strongly marked, four axillary veins. Wings hyaline, veins testaceous. Abdomen fuscous above and beneath becoming rather paler towards the extremity; supra-anal lamina produced subquadrately, testaceous, posterior border slightly emarginate; sub-genital lamina semi-orbicular, ample, with large acuminate styles (cerci mutilated, fuscous). Legs testaceous, coxæ with fuscous line on outer border; front femora with ten spines on the anterior margin beneath, extending from the middle to the apex, the middle ones longest, four spines on posterior margin, mid-femora with six spines on anterior margin, three on posterior margin, hind femora with six spines on anterior margin, four on posterior margin, formula of apical spines $\frac{2}{1}$, $\frac{1}{1}$, $\frac{1}{1}$, of genicular spines 0, 1, 1.

Total length, 18 mm.; length of body, 12·2 mm.; length of tegmina, 15 mm.; breadth of pronotum, 6·5 mm.

The other specimen is slightly darker in colour. ♂. Eyes whitish-grey, face testaceous, a rufo-fuscous stripe on the frons extending down to the base of the clypeus, thinning out to a line on the vertex. Pronotum more trapezoidal, lateral margins hyaline. Tegmina with two-branched mediastinal vein, radial vein giving off eleven costals, its end ramose, seven axillary veins. Abdomen rufous beneath with the disc paler; supra-anal lamina triangularly produced; sub-genital lamina narrow, produced, asymmetrical with one acuminate style. Front femora with two spines on anterior margin beneath in the middle, four on the posterior margin (hind femora lost), formula of apical spines, $\frac{3}{1}$, $\frac{1}{0}$?

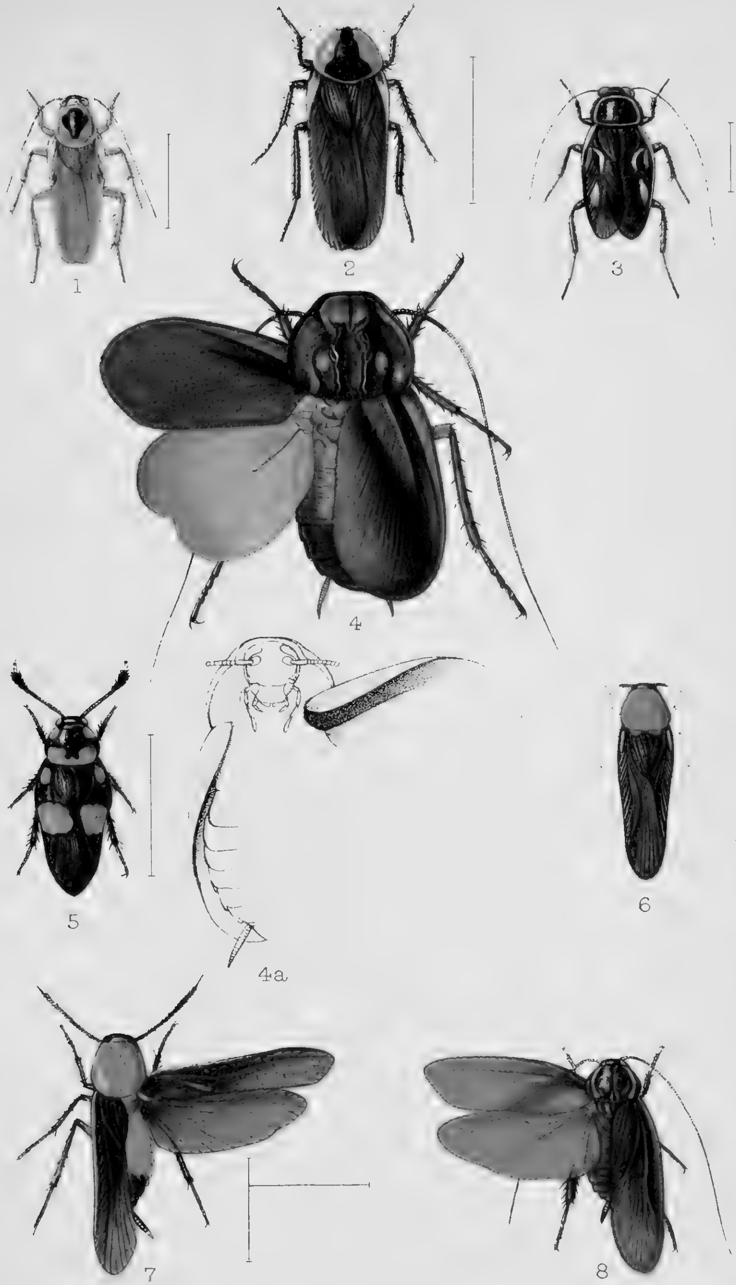
Total length, 25·1 mm.; length of body, 17 mm.; length of tegmina 21 mm.; (pronotum crushed).

Which of these two specimens, if either, is identical with the *Blatta grisea* of De Geer it is not possible to say; it would scarcely be wise to sink *brasiliensis* as a synonym of *grisea* and I hesitate also to give a name to the second of Fabricius' specimens.

Explanation of Plates.

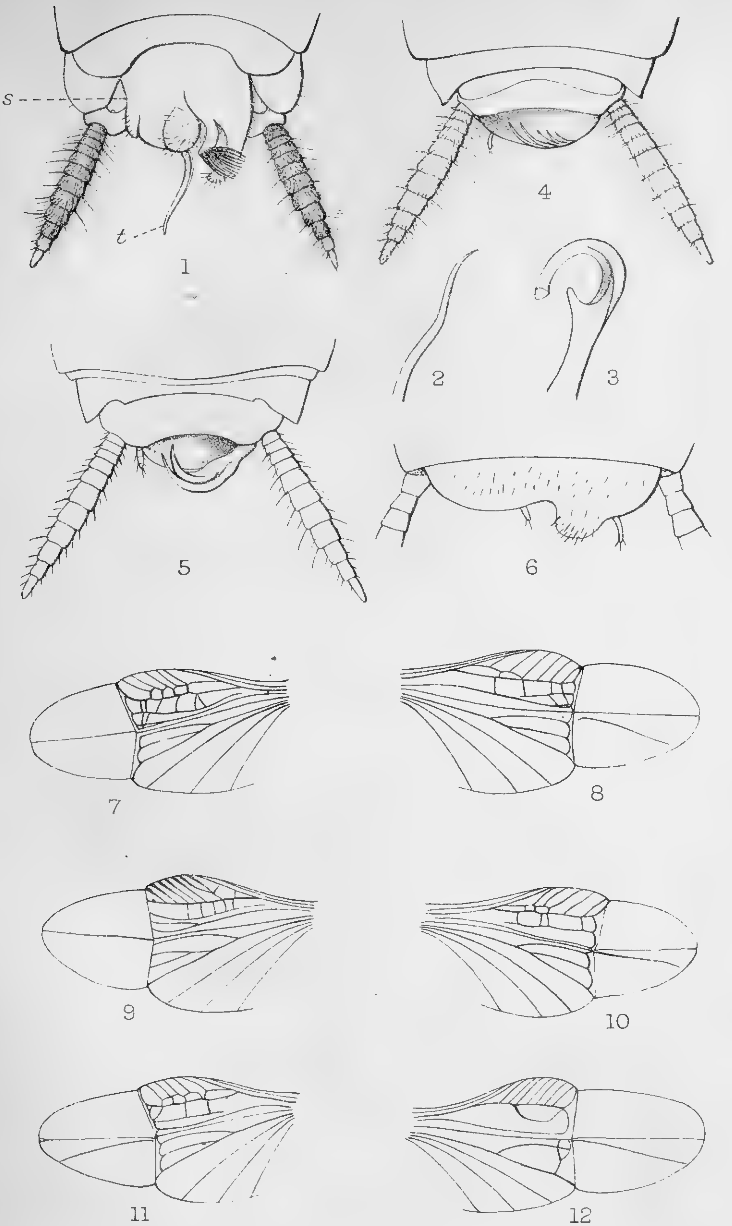
Plate XIV.

Fig. 1. *Pseudomops burri*, n. sp. (Type ♂.)
2. ,, *discicollis*, Burm., ♀.
3. *Pseudophyllodromia pulcherrima*, n. sp. (Type ♂.)
4. *Miroblatta petrophila*, n. sp. (Type ♂.) Nat. size.
4*a*. Ventral aspect of same, showing the "epipleura."
5. *Thyrsocera speciosa*, Wlk. (Type ♀.)
6. *Pseudothyrsocera ruficollis*, n. sp. (Type ♂.)
7. *Pseudomops bicolor*, n. sp. (Type ♂.)
8. *Homalosilpha decorata*, Serv., ♂. Nat. size.



H. Knight del. et lith.　　West, Newman chromo.

NEW SPECIES OF BLATTIDÆ.



H. Knight del. et lith. West, Newman imp.

NEW SPECIES OF BLATTIDÆ

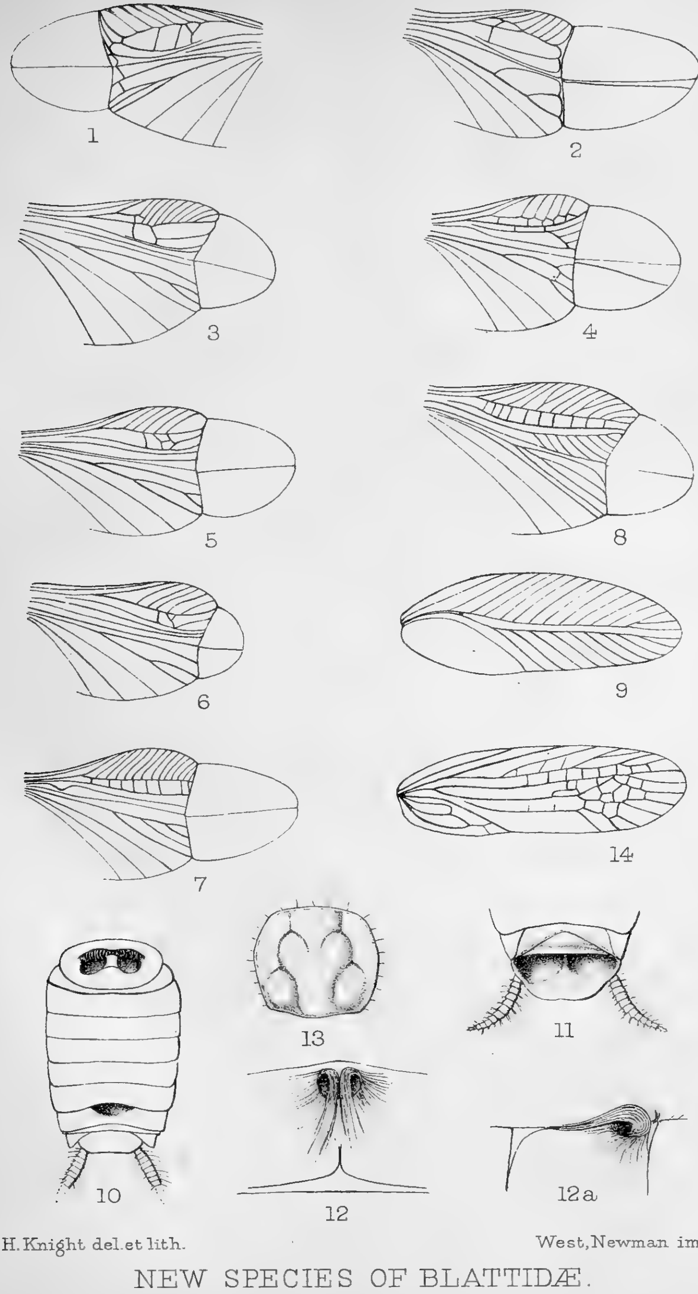
PLATE XV.

FIG. 1. Sub-genital lamina of *Hemithyrsocera histrio*, Burm., ♂ *s.* = spiracle, *t.* = "titillator."

2. "Titillator" of *Hemithyrsocera lateralis*, Wlk.
3. ,, ,, *Theganopteryx æthiopica*, Sss.
4. End of abdomen of *Escala circumducta*, Wlk., ♂, dorsal view.
5. End of abdomen of *Escala longiuscula*, Wlk., ♂, dorsal view.
6. Sub-genital lamina of *Escala insignis*, n. sp. ♂.
7. Wing of *Anaplecta maculata*, n. sp.
8. ,, ,, *zeylanica*, n. sp.
9. ,, ,, *thwaitesi*, n. sp.
10. ,, ,, *malayensis*, n. sp.
11. ,, ,, *borneensis*, n. sp.
12. ,, ,, *obscura*, n. sp.

PLATE XVI.

FIG. 1. Wing of *Anaplecta brunneri*, n. sp.
2. " " *dahomensis*, n. sp.
3. " " *pavida*, n. sp.
4. " " *fusca*, n. sp.
5. " " *varipennis*, n. sp. (long-winged form).
6. " " " " (short-winged form).
7. " " *chrysoptera*, n. sp.
8. " *Anaplectoidea nitida*, n. sp.
9. Tegmen of *Anaplectoidea nitida*, n. sp.
10. Dorsal view of abdomen of *Ischnoptera montis*, n. sp. ♂.
11. End of abdomen of *Ischnoptera excavata*, n. sp. ♂, dorsal view.
12. Opening of scent-glands in *Pseudomops bicolor*, n. sp. ♂, dorsal view ; *a*, side view.
13. Pronotum of *Homopteroidea nigra*, n. sp.
14. Tegmen of *Homopteroidea nigra*, n. sp.



H. Knight del. et lith. West, Newman imp.

NEW SPECIES OF BLATTIDÆ.

XXI. *Studies of the* Blattidæ (*continued*). By R. Shelford, M.A., F.L.S.

[Read November 21st, 1906.]

Plate XXX.

V. The types of *Blattidæ* described by Francis Walker, and now in the Hope Museum, Oxford.

These types are all contained in the collection of Mr. W. W. Saunders which was presented in 1873 to the Oxford Museum by Mrs. F. W. Hope; the new species in this collection were described by Walker in his "Catalogue of Blattariæ" (1868); and in a supplementary volume, "Catalogue of Dermaptera Saltatoria and Blattariæ," published in 1869.

Owing to the inadequacy of Walker's descriptions and to his elastic views of generic limitations many of his species can only be recognized by those who have access to his types. A careful revision of Walker's work on *Blattidæ* is urgently needed, and the notes here presented are a first contribution towards a complete revision; thanks to Mr. Kirby's "Synonymic Catalogue of Orthoptera," vol. i (1904), the task has not proved so difficult as might have been expected. The species are discussed here not in the order in which they were arranged by Walker, but in the order that they take in modern and received systems of classification of the *Blattidæ*. Wherever it has appeared necessary the species have been re-described, but in some cases Walker's descriptions are quite recognizable, once the generic positions of his species have been fixed.

Family BLATTIDÆ.

Sub-fam. *ECTOBIINÆ.*

1. *Theganopteryx apicigera*, Wlk.

Blatta apicigera, Walker. Cat. Blatt. B. M. p. 227 (1868).
Theganopteryx apicigera, Shelford, Trans. Ent. Soc. (1906), p. 235.

♀. Java (*Wallace*).

2. *Escala circumducta*, Wlk.

Blatta circumducta, Walker. Cat. Blatt. B. M. Suppl. p. 142 (1869).
Escala circumducta, Shelford, Trans. Ent. Soc., p. 239, Pl. XV, f. 4 (1906.)

♂. S. Australia.

3. *Escala longiuscula*, Wlk.

Blatta longiuscula, Walker, l. c. p. 143 (1869).
Escala longiuscula, Shelford, l. c. p. 239. Pl. XV, f. 5 (1906).

♂. S. Australia.

4. *Hemithyrsocera fissa*, Wlk.

Pseudomops fissa, Walker, l. c. p. 213 (1868).

♂. Sumatra (*Wallace*).

This is synonymous with *H. histrio*, Burm. (cf. Trans. Ent. Soc. 1906, p. 238.)

Sub-fam. *PHYLLODROMIINÆ.*

5. *Pseudomops inclusa*, Wlk.

Pseudomops inclusa, Walker, l. c. p. 212 (1868).
Thyrsocera amœna, de Saussure, Mél. Orthop. IV, p. 97 (1872).

♂. Brazil.

6. *Pseudothyrsocera pica*, Wlk.

Pseudomops pica, Walker, l. c. p. 213 (1868).
Pseudothyrsocera pica, Shelford, l. c. p. 250 (1906).

♂. Singapore (*Wallace*). ♀. Sumatra (*Wallace*).

7. *Pseudothyrsocera scutigera*, Wlk.

Pseudomops scutigera, Walker, l. c. p. 212 (1868).

♂. Sarawak (*Wallace*).

8. *Pseudothyrsocera xanthophila*, Wlk. (Plate XXX, figs. 1 and 2).

Blatta xanthophila, Walker, l. c. p. 230 (1868).

♂. Menado, Celebes (*Wallace*).

Fulvous. Antennæ black, slightly incrassated in basal half and hirsute; apex of maxillary palpi black. Pronotum trapezoidal, covering vertex of head. Tegmina with thirteen costal veins, discoidal field with seven longitudinal sectors, three of which are given off from the anterior ulnar branch, four from the posterior ulnar, the latter are strongly angled. Supra-anal lamina triangular, produced, the posterior angles bear each a short downwardly directed spine; sub-genital lamina produced, narrow, covered with a dense pile of long hairs, asymmetrical, the left posterior angle strongly produced, no styles.

Total length 13 mm.; length of tegmina 10·8 mm.

9. *Ischnoptera reversa*, Wlk.

Ischnoptera reversa, Walker, l. c. p. 147 (1869).

♂. Singapore (*Wallace*).

Rufo-castaneous. Basal half of antennæ, terminal joints of maxillary and labial palpi, fuscous. Pronotum trapezoidal, sides deflexed, not covering vertex of head. Tegmina with nineteen costal veins, discoidal field with ten longitudinal sectors. Wings with the mediastinal vein three-branched, radial vein unbranched, twelve costal veins, ulnar vein with nine branches, three of which go towards the dividing vein. Supra-anal lamina triangular, sub-genital lamina ample, its border notched, two styles. Legs with the genicular angles of the femora, the tibæ and tarsi fuscous, all the femora with genicular spines, formula of apical spines, $\frac{1}{1}$, $\frac{1}{1}$, $\frac{1}{1}$, anterior margin of front femora with numerous spines, the more distal short and closely set.

Total length 20 mm.; length of body 13 mm.; length of tegmina 15 mm.

10. *Ischnoptera erythrina*, Wlk.

Blatta erythrina, Walker, l. c. p. 219 (1868).

♀. Brazil.

This is synonymous with *Ischnoptera rufa*, Br.

11. *Phyllodromia colligata*, Wlk.

Blatta colligata, Walker. l. c. p. 221 (1868).
Phyllodromia bisignata, Brunner, Ann. Mus. Civ. Gen. xxxiii, p. 15, pl. 1. f. 1 (1893).

The type, which is in a very fragmentary condition, is from Amoy.

12. *Phyllodromia amplectens*, Wlk.

Blatta amplectens, Walker, l. c. p. 223 (1868).

Sex ? (abdomen lost). MORTY (*Wallace*).

Fulvous. Pronotum with a fuscous horseshoe-shaped marking, the limbs of the horseshoe directed forward and not attaining the anterior border of the pronotum. Tegmina with sixteen costal veins, discoidal field with eight longitudinal sectors.

Total length 16·2 mm.; length of tegmina 13 mm.

13. *Phyllodromia funebris*, Wlk.

Blatta funebris, Walker, l. c. p. 225 (1868).

♂. SARAWAK (*Wallace*).

Pronotum not covering vertex of head, trapezoidal, sides scarcely deflexed, margined. Tegmina with twelve costal veins, the last three bifurcated. Supra-anal lamina triangular, sub-genital lamina ample, its posterior border slightly emarginate. Anterior border of front femora with three long spines in the middle, numerous piliform spines distally.

Near *P. lycoides*, Wlk., from India.

14. *Phyllodromia hamifera*, Wlk.

Blatta hamifera, Walker, l. c. p. 224 (1868).

♂. SARAWAK (*Wallace*).

The species is allied to *P. variegata*, Br., from Java. Walker's description sufficiently illustrates its differences from that species.

15. *Phyllodromia contingens*, Wlk. (Plate XXX, fig. 4.)

Blatta contingens, Walker, l. c. p. 229 (1868).
Blatta humeralis, Walker, l. c. p. 140 (1869).

♂. (*humeralis*) SINGAPORE (*Wallace*).
♀. (*contingens*) SARAWAK (*Wallace*).

Flavo-testaceous. Antennæ longer than total length. Pronotum transversely elliptical, lateral margins hyaline, posterior border not produced. Lateral margins of tegmina broadly hyaline, mediastinal area areolated, eleven costal veins. Supra-anal lamina of male shortly produced, trigonal, sub-genital lamina with the posterior angles produced to form two setiform processes, the styles situated in deep notches; supra-anal lamina of female short, transverse, sub-genital lamina ample, semi-orbicular.

♂. Total length 13 mm.; length of body 10 mm.; length of tegmina 10 mm.

♀. Total length 15 mm.; length of body 10 mm.; length of tegmina 12·8 mm.

16. *Phyllodromia sequens*, Wlk.

Blatta sequens, Walker, l. c. p. 229 (1868).

Sex? (abdomen lost). MACASSAR, CELEBES (*Wallace*).

Fulvo-testaceous; head not covered by pronotum, which is elliptical, and slightly produced behind, its lateral margins pellucid. Tegmina with eleven costals, anterior ulnar with four branches, posterior ulnar simple. Front femora with 8 long spines on the anterior margin beneath, all the femora with genicular spines, formula of apical spines $\frac{1}{1}$, $\frac{1}{1}$, $\frac{1}{1}$. Total length 13·2 mm.; length of tegmina 11 mm.

17. *Phyllodromia virescens*, Wlk.

Blatta virescens, Walker, l. c. p. 231 (1868).

♀. SARAWAK (*Wallace*).

The species is readily recognizable by its pale green colour. Small; pronotum not covering vertex of head, trapezoidal, margins broadly hyaline. Tegmina hyaline, eleven to twelve costals, discoidal sectors oblique. Supra-anal lamina trigonal, sub-genital lamina ample, cerci elongate. Front femora with close-set piliform spines on anterior margin.

18. *Phyllodromia suffusa*, Wlk.

Blatta suffusa, Walker, l. c. p. 223 (1868).

Sex? (tip of abdomen mutilated). NEW GUINEA (*Wallace*).

Flavo-testaceous. Antennæ flavo-testaceous at base, terminal half fuscescent, basal half fuscous. Pronotum trapezoidal, not covering vertex of head, lateral margins pellucid, sides not deflexed,

posterior margin straight. Tegmina with ten costal veins, anterior ulnar with five oblique branches, posterior ulnar simple. Wings with eleven costals their apices incrassated, ulnar vein with three branches. Front femora armed on the anterior margin beneath with minute piliform spines, armature of the other femora very sparse; no genicular spine on anterior femora.

19. *Phyllodromia laterifera*, Wlk.

Blatta laterifera, Walker, l. c. p. 231 (1868).

♀. Sarawak (*Wallace*).

20. *Phyllodromia propinqua*, Wlk.

Blatta propinqua, Walker, l. c. p. 228 (1868).
Blatta contigua, Walker, l. c. p. 228 (1868).

♀. (*propinqua*). Macassar, Celebes (*Wallace*).
♀. (*contigua*). New Guinea (*Wallace*).

21. *Phyllodromia majuscula*, Wlk.

Blatta majuscula, Walker, l. c. p. 139 (1869).

♀. Chan-ti-bon, Siam (*Mouhot*).

These three species are all large testaceo-hyaline forms with broadly elliptical pronotum, broad tegmina with the marginal area equalling half the total breadth. They may be distinguished by the form of the supra-anal lamina :—

a. Supra-anal lamina triangular and cleft at the apex ; total length 17 mm. . . . . *P. propinqua.*
aa. Supra-anal lamina not cleft at the apex.
b. Supra-anal lamina short, transverse ; total length 18 mm. . . . . *P. laterifera.*
bb. Supra-anal lamina, slightly produced, trigonal ; total length 21 mm. . . . . *P. majuscula.*

22. *Phyllodromia elegans*, Wlk.

Blatta elegans, Walker, l. c. p. 226 (1868).

♂. Sarawak (*Wallace*).

23. *Phyllodromia picticollis*, Wlk.

Blatta picticollis, Walker, l. c. p. 140 (1869).

♀. Macassar, Celebes (*Wallace*).

24. *Phyllodromia guttifera.* Wlk.

Blatta guttifera, Walker, l. c. p. 230 (1868).

♂. Aru Is. (*Wallace*).

This and the two preceding species are all very closely allied. They are fulvo-testaceous insects about 17 mm. in total length with very long slender antennæ and with the tegmina projecting considerably beyond the end of the body; the venation of the tegmina is the same in all species, there being twenty to twenty-one costal veins, eight discoidal longitudinal sectors and the radial vein is bifurcated.

The following may be considered the differential characters of the three species:

Pronotum with disc fusco-castaneous, a W-shaped mark and central line testaceous, margins testaceous. Coxæ not spotted. Supra-anal lamina narrow, produced, triangular; sub-genital lamina irregular, deeply cleft; titillator nearly straight	*P. elegans*
Pronotum with disc rufo-castaneous, a dumb-bell-shaped mark and margins testaceous. Coxæ not spotted. Supra-anal lamina incised at apex . . .	*P. picticollis.*
Pronotum fulvous with irregular paler marking on disc. Coxæ spotted with castaneous. Supra-anal lamina broad, produced, triangular; sub-genital lamina narrow, not cleft; titillator strongly curved	*P. guttifera.*

25. *Phyllodromia polygrapha,* Wlk.

Blatta polygrapha, Walker, l. c. p. 222 (1868).

Sex? (abdomen missing).

Chan-ti-bon, Siam (*Mouhot*).

This is closely allied to *P. hieroglyphica,* Br. but the head and pronotum are much more heavily marked with castaneous and the femora have their posterior margins marked with fuscous.

26. *Phyllodromia obtusifrons,* Wlk.

Blatta obtusifrons, Walker, l. c. p. 226 (1868).

♀. Sarawak (*Wallace*).

Fulvo-testaceous. Head castaneous, antennæ twice as long as the body. Pronotum trapezoidal, barely covering vertex of head, posterior margin very slightly angled, sides only slightly deflexed,

disc marked with castaneous dots and lines symmetrically arranged. Tegmina with marginal field equalling half the total breadth, radial vein bifurcated, the lower branch ramose and sending its branches to the apical part of the anterior margin, eleven costals, anterior ulnar with five branches, posterior ulnar simple. Ulnar vein of wings with four branches. Supra-anal lamina shortly produced; subgenital lamina ample, semi-orbicular; cerci elongate. Insertions of tibial and femoral spines marked with fuscous.

27. *Phyllodromia ignobilis,* Wlk.

Blatta ignobilis, Walker, l. c. p. 224 (1868).

♀. Sula Is. (*Wallace*).

This is a small species, which can be recognized by the colouring of the tegmina; in these the veins are pale and the interstices filled with flavo-testaceous, in addition there are numerous castaneous points situated on the veins. The costal veins of the wing are somewhat irregular and their ends are clavate, they are ten in number, the ulnar vein has three branches and there is a prominent triangular apical area. The anterior margin of the front femora beneath are armed only with minute and close-set piliform spines.

28. *Phyllodromia marmorata,* Wlk.

Blatta marmorata, Walker, l. c. p. 140 (1869).

♀. Mt. Ophir, Malacca (*Wallace*).

A pale testaceous species, marbled with castaneous evidently a cryptic coloration.

29. *Phyllodromia extenuata,* Wlk.

Blatta extenuata, Walker, l. c. 221 (1868).

♂. Egypt.

This is synonymous with *P. supellectilium,* Serv.

30. *Phyllodromia annulicornis,* Wlk.

Blatta annulicornis, Walker, l. c. p. 219 (1868).

♂. Para, Brazil.

Head black, shining; eyes pale; antennæ fuscous, with a testaceous annulus occupying eight joints, before the middle. Pronotum black, shining, with the posterior and lateral margins pale testaceous, not covering vertex of head, posterior margin slightly produced.

Tegmina rufo-testaceous, infuscated at base, fifteen costal veins, discoidal field reticulated. Abdomen and legs black, tibial spines and apical tarsal joints rufous. Sub-genital lamina small, narrow, quadrate, with two styles.

31. *Pseudectobia bipunctata*, Wlk. (Plate XXX, fig. 3.)

Blatta bipunctata, Walker, l. c. p. 141 (1869).

♀. Macassar, Celebes (*Wallace*).

The species is rather convex, the marginal field of the tegmina is broad, the veins of the discoidal field are very indistinct, a triangular apical area is present in the wings, the supra-anal lamina is short and transverse and the femora are sparsely armed, which characters taken in conjunction may be considered as diagnostic of the genus *Pseudectobia.*

32. *Pseudophyllodromia laticeps*, Wlk.

Blatta laticeps, Walker, l. c. 142 (1869).
Phyllodromia laticaput, Brunner, Abhandl. Senckenb. Ges. xxiv, p. 205, pl. 16, f. 9 (1898).

♀. Singapore (*Wallace*).

In Singapore examples the disc of the abdomen beneath is testaceous, whereas in examples from Borneo (= *laticaput*, Br.) this is rufous, otherwise the two forms are identical.

33. *Allacta latirupta*, Walk.

Blatta mundicola, Walker, l. c. p. 101 (1868).
Blatta latirupta, Walker, l. c. p. 143 (1869).
Blatta patula, Walker, l. c. p. 143 (1869).
Blatta bitæniata, de Saussure, Mél. Orthopt. II, p. 63 (1869).

♂. (= *latirupta*, Wlk.) New South Wales.
♀. (= *patula*, Wlk.) Sydney.

A. mundicola, Wlk. is the earliest name for this species.

34. *Duryodana palpalis*, Wlk.

Blatta palpalis, Walker, l. c. p. 225 (1868).
Phyllodromia palpata, Brunner, Abhandl. Senckenb. Ges. xxiv, p. 207, pl. 16, f. 13 (1898).

♂. Sarawak (*Wallace*).

Sub-fam. *EPILAMPRINÆ*

35. *Pinaconota obliqua*, Wlk. (Plate XXX, fig. 5.)

Ischnoptera (?) *obliqua*, Walker, l. c. 148 (1869).

♂. Brazil.

Pale testaceous. Head castaneous, a fuscous band between the eyes, clypeus and mouth-parts testaceous, sparsely but deeply punctate; antennæ about half the body-length, testaceous. Pronotum transversely elliptical, anterior margin truncate, not nearly covering vertex of head; posterior margin nearly straight, sides deflexed, with large scattered punctures; two angulate black vittæ extend from the anterior to the posterior margins. Tegmina with basal fourth punctate, a short humeral stripe castaneous, radial vein bifurcated, extremities ramose, ten costal veins, discoidal field reticulate. Scutellum exposed, marked with castaneous, punctate. Supra-anal lamina large, fimbriated; sub-genital lamina large with two styles asymmetrically placed; cerci short; legs short, the front and mid tibiæ shorter than the corresponding femora. Front femora armed on the anterior margin beneath with a close-set row of short spines, two spines on the posterior margin; mid-femora with twelve spines on anterior, four on posterior margin; hind-femora with five spines on anterior, four on posterior margin beneath; the spines on the anterior margin about half the length of those on the posterior margin; formula of apical spines $\frac{3}{1}$, $\frac{1}{1}$, $\frac{1}{0}$; minute genicular spines on mid- and hind-femora. Tarsi short, both tibiæ and tarsi fimbriated, posterior metatarsus shorter than remaining joints; pulvilli large. Total length 21 mm.; length of body 18 mm.; length of tegmina 17 mm.; pronotum 5 mm. × 7 mm.

This somewhat remarkable species appears to be undoubtedly referable to the genus *Pinaconota*, Sauss., it can be distinguished from the only other species in the genus, *P. bifasciata*, Sauss., by its much larger size.

36. *Molytria dotata*, Wlk.

Epilampra dotata, Walker, l. c. p. 130 (1869).

♀. Singapore (*Wallace*).

The same as *Molytria badia*, Br.

37. *Molytria polyspila*, Wlk.

Epilampra polyspila, Walker, l. c. p. 197 (1868); l. c. p. 133 (1869).

♂. SINGAPORE (*Wallace*); ♀. SARAWAK (Wallace).

This is synonymous with *M. maculata*, Br.; *M. shelfordi*, Kirby, is merely the Bornean race.

38. *Molytria ramifera*, Wlk.

Epilampra ramifera, Walker, l. c. p. 132 (1869).

♂. SUMATRA (*Wallace*).

The species is very close, perhaps too close to *M. badia*, Br.; it differs by the paler colour of the pronotum and tegmina, by the more rufous coloration of the abdomen and legs, by the narrower pronotum (11 mm. × 14·5 mm. as against 11 mm. × 17 mm. in *badia*) and by the more ample subgenital lamina and more spatulate styles.

39. *Homalopteryx basifera*, Wlk.

Epilampra basifera, Walker, l. c. p. 131 (1869).

♂. CERAM (*Wallace*).

Synonymous with *H. macassariensis*, Haan.

40. *Homalopteryx adusta*, Wlk. (Plate XXX, fig. 6.)

Epilampra adusta, Walker, l. c. p. 131 (1869).

♀. SARAWAK (*Wallace*).

Head testaceous, a cruciform castaneous marking on the front, vertex with small castaneous points, apex of maxillary palpi castaneous. Pronotum with the disc castaneous, the lateral margins broadly testaceous, marked with numerous castaneous points, the surface granular, two impressions on the disc, black, lateral margins slightly reflected, posterior margin with a row of larger granules. Tegmina testaceous heavily mottled with castaneous, marginal area paler, serio-punctate, just failing to reach extremity of abdomen. Abdomen beneath with the disc heavily mottled with castaneous, margins testaceous; supra-anal lamina bilobate, sub-genital lamina ample; cerci testaceous. Legs testaceous, dotted with castaneous, four spines on anterior margin of front femora, formula of apical spines $\frac{1}{0}$, $\frac{1}{1}$, $\frac{1}{0}$, no genicular spine on front femora; posterior metatarsus shorter than remaining joints, spinous beneath, pulvillus not produced backwardly. Total length 23 mm.; length of tegmina 17 mm.; pronotum 8·5 mm. × 12 mm.

41. **Pseudophoraspis conformis,* Wlk.

Epilampra conformis, Walker, l. c. p. 200 (1868).
Epilampra scita, Walker, l. c. p. 200 (1868).

♀. SARAWAK (*Wallace*). "From the stomach of a cuckoo, *Phœnicophæus erythrognathus*" [*conformis*].
♀. SUMATRA (*Wallace*) [*scita*].

Both these species and also *P. congrua,* Wlk., are the same and synonymous with *P. nebulosa,* Burm. The species is highly variable both in size and coloration, but the study of a long series from all the greater Sunda Is. convinces me that there is no character that can be relied on to discriminate distinct species; the Bornean race is generally larger and with the veins of the marginal area of the tegmina more strongly marked; but even these characters are not constant.

42. *Hedaia concinnula,* Wlk.

Epilampra concinnula, Walker, l. c. p. 134 (1869).

♀. TIMOR (*Wallace*).

The species is very close to *H. procera,* Br., but differs in the more heavily armed front femora, the sinuate tip of the wing and more mottled coloration of the tegmina.

43. *Hedaia parvicollis,* Wlk.

Epilampra parvicollis, Walker, l. c. p. 133 (1869).

♂. SARAWAK (*Wallace*).

Very like *H. procera,* Br., but the pronotum is much smaller, measuring 7 mm. × 8·5 mm., its anterior angles are less rounded, its anterior margin less arcuate, so that in general appearance it is more like a heraldic shield than is usual in the genus *Hedaia.* The posterior margin of the subgenital lamina is sinuate and from the slightly produced posterior angles spring the slender styles.

44. *Epilampra inclarata,* Walk.

Epilampra inclarata, Walker, l. c. p. 198 (1868).

♀. SARAWAK (*Wallace*).

* This genus is very badly defined, but the genus *Epilampra* is already so unwieldy that one is induced to welcome any attempt to split it up.

Allied to *E. saravacensis*, Shelf. Testaceous; the ground-colour however obscured by a dense castaneous maculation and vermiculation. Pronotum not covering vertex of head, not punctate, posterior margin angulate, 9·5 mm. × 13 mm. Large ocelliform spots on the distal halves of the tegmina; mediastinal vein stout with three short branches and one slender ramose branch, costals few but highly ramose; surface of tegmina not punctate. Wings with marginal field semi-coriaceous and suffused with castaneous, apex not sinuate or angulate. Sub-genital lamina produced, trigonal. Front femora beneath with eight spines on anterior margin, two on posterior margin, no genicular spine; formula of apical spines $\frac{2}{1}$, $\frac{1}{1}$, $\frac{1}{1}$.

45. *Epilampra plena*, Wlk.

Epilampra plena, Walker, l. c. p. 211 (1868).
Epilampra fervida, Walker, l. c. p. 211 (1868).

♀. Macassar, *Celebes* (Wallace) [*plena*].
♀. Macassar, *Celebes* (Wallace) [*fervida*].

E. plena, Wlk.; *E. puncticollis*, Wlk.; *E. quadrinotata*, Wlk.; *E. lævicollis*, Sss., and *E. flavomarginata*, Shelf. form a congeries of species that it is not easy to discriminate; the differences in coloration are slight, and it is almost impossible to express them in writing. The species are small, averaging 25 mm. in total length; they are amber-coloured or testaceous, the ground-colour however being obscured by densely placed and minute castaneous or fuscous maculæ, and vermiculatious, so that the insects appear to be of some shade of castaneous. The pronotum does not cover the vertex of the head, its posterior margin is obtusely angled and produced, its surface is quite smooth. The posterior legs are long and slender, the metatarsus particularly so, and the pulvilli are margined with spines. The veins of the tegmina are strongly marked, and between them at the base only of the tegmen appear series of shallow ill-marked punctures. *E. puncticollis*, Wlk., from Borneo can be distinguished by two converging impressions on the front part of the pronotum; *E. lævicollis*, Sss., from Java is possibly synonymous; *E. quadrinotata*, Wlk., from Borneo is smaller (20 mm. total length), has four fuscous maculæ on the pronotum, and the supra-anal lamina is notched deeply, not merely cleft; *E. plena*, Wlk., from Celebes and New Guinea has no impressions on the pronotum and is larger than *quadrinotata*, the form *fervida*

is less heavily marked and is of a rufous hue; *E. flavomarginata*, Shelf., can be distinguished by its coloration. A revision of the genus *Epilampra* is much to be desired, but without a comparison of all the types it is a matter of such consummate difficulty that it has been shirked by every student of the Blattidæ. The species noted above might well be considered typical of Kirby's genus *Heterolampra*, but Mr. Kirby in his Synonymic Catalogue of Orthoptera includes in it all the old world species of *Epilampra* that cannot be fitted into the genera *Hedaia* and *Calolampra;* the result is a heterogeneous assemblage, whose diagnostic generic characters are in most cases merely their locality labels.

46. *Epilampra varia*, Wlk. (Plate XXX, fig. 9.)

Epilampra varia, Walker, l. c. p. 130 (1869).

♀. SARAWAK (*Wallace*).

Head flavo-testaceous, with a large black patch covering nearly the whole of the front from between the eyes to the labrum, vertex mottled with castaneous; antennæ broken; eyes pale. Pronotum not covering vertex of head, its posterior margin truncate, sides deflexed, smooth, shining, dark castaneous, all the margins flavo-testaceous, spotted with castaneous. Tegmina short, reaching only to the middle of the penultimate segment, coriaceous, smooth and shining, the venation obsolescent, the anal and axillary veins being entirely absent; serio-punctate, the punctures indicating the obsolescent venation; flavo-testaceous heavily marked with castaneous, the part of the right tegmen overlapped by the left castaneous, its surface reticulated. Wings equalling in length the tegmina, marginal area coriaceous. Supra-anal lamina not markedly bilobate, its posterior margin merely notched slightly; sub-genital lamina ample; cerci short, flavid. Legs mottled with castaneous; front femora with three stout spines on anterior margin beneath, one on posterior margin; formula of apical spines $\frac{2}{1}$, $\frac{1}{1}$, $\frac{1}{1}$.

Total length 28·5 mm.; length of tegmina 20 mm.; pronotum 8·5 mm. × 11 mm.

This species, together with *E. imitans*, Br., and an undescribed species from the Malay Peninsula, might constitute a new sub-genus, distinguished by the reduced

wings and tegmina and the truncate or shortly produced posterior margin of the pronotum; they are smooth shining insects somewhat ovate in form.

Sub-fam. *BLATTINÆ.*

47. *Methana oculata*, Wlk.

Periplaneta oculata, Walker, l. c. p. 152 (1869).

♀. AUSTRALIA.

Synonymous with *Methana soror*, Sss.

48. *Pelmatosilpha aterrima*, Wlk.

Periplaneta aterrima, Walker, l. c. p. 151 (1869).
Pelmatosilpha præstans, Dohrn. Stett. Ent. Zeit. xlviii, p. 411 (1887).

♂. PERU.

Kirby regards *P. aterrima*, Wlk., as synonymic with *Nyctibora tenebrosa*, Wlk. (Syn. Cat. Orth. I, p. 108, 1904); this is certainly erroneous, as *tenebrosa* is a true *Nyctibora*.

49. *Thyrsocera speciosa*, Wlk.

Ellipsidium speciosum, Walker, l. c. p. 214 (1868).
Thyrsocera speciosa, Shelford. Trans. Ent. Soc., 1906, p. 249, Pl. xiv, fig. 5.

♀. "EASTERN ARCHIPELAGO" (*Wallace*).

Sub-fam. *PANCHLORINÆ.*

50. *Leucophæa conferta*, Wlk.

Ischnoptera conferta, Walker, l. c. p. 148 (1869).

♂. CHAN-TI-BON, SIAM (*Mouhot*).

Testaceous. Head with large castaneous marking on the front, extending to base of clypeus. Pronotum punctate, disc with a large castaneous lyrate mark, margins hyaline. Tegmina serio-punctate at base, testaceo-hyaline, veins castaneous; both tegmina and wings extend considerably beyond apex of abdomen. Sub-genital lamina shortly transverse, an asymmetrical projecting lobe on the right side. Legs testaceous, femora marked with castaneous towards apex.

51. *Tribonium guttulosum*, Wlk.

Nauphœta guttulosa, Walker, l. c. p. 184 (1868).

♀. Brazil.

Allied to *T. elegans*, Br., but much larger, head entirely black, apical half of antennæ fulvous, pronotum and tegmina more heavily marked, abdomen and legs darker.

52. *Stenoblatta paralella*, Wlk. (Plate XXX, figs. 7, 7a.)

Stenoblatta paralella, Walker, l. c. p. 193 (1868).

3 ♀♀. Brazil.

This extraordinary linear and flattened cockroach has apparently not been met with since Walker's description of it appeared. Walker placed it in his family *Hypnormidæ* (= *Plectopterinæ*) and Kirby (Syn. Cat. Orth. I, p. 179) places it at the end of the *Plectopterinæ*; but since the wings do not possess a triangular intercalated area this classification is evidently wrong; the large, produced supra-anal lamina with notched margin and the presence of large arolia between the tarsal claws fix the position of the genus amongst the *Panchlorinæ* of which sub-family, it may be considered an aberrant member.

Walker's description, so far as it goes, is quite accurate, except in his determination of the sex of the specimens, and the following may be regarded as merely supplementary to it:—

Head much flattened, the vertex between the eyes forming a sharp edge, semicircular in outline, eyes very narrow. Tegmina punctate at base, radial vein very straight, bifurcate, the lower branch ramose, costals numerous, obsolete and irregular, five discoidal sectors, discoidal field reticulated, nine axillary veins. Wings with anterior half flavid, posterior field infuscated, costal veins highly irregular and reticulated, median vein quite straight, ulnar vein with five branches, two of which go to the dividing vein. Supra-anal lamina projecting considerably beyond the sub-genital lamina; cerci equal in length to supra-anal lamina. Legs very short, femora without spines, tibiæ very sparsely spined, the front pair with four apical spines only, hind pair with a few in a double row on the upper border, two only on the lower border and four apical spines. Arolia relatively enormous, tarsi only half-length of tibiæ, which are two-thirds length of femora, metatarsus not longer than the following three joints, shorter than the last joint.

53. *Oniscosoma punctosa*, Wlk.

Ischnoptera (?) *punctosa*, Walker, l. c. p. 149 (1869).
Ischnoptera punctuosa, Tepper, Tr. R. Soc. S. Austral. xvii, p. 55 (1893).
Pseudopanchlora punctosa, Kirby, Syn. Cat. Orth. i, p. 189 (1904).

♂. Australia.

Head castaneous, darkest on the frons which is very concave; ocelli testaceous; eyes wide apart; on the vertex a longitudinal carina testaceous in colour; antennæ mutilated, fuscous. Pronotum cucullate, an anterior carina, two converging impressions posteriorly; its surface covered with granules, anterior margin slightly reflexed, posterior margin angulate; testaceous with castaneous mottlings and a quadrate castaneous patch on posterior part of disc. Tegmina testaceous, mottled with castaneous, six to seven costal veins. Wings hyaline, venation as in *O. granicollis*, Sss. Abdomen above testaceous, below testaceous with a castaneous patch on the disc; supra-anal lamina short not projecting so far as the sub-genital lamina; cerci short.

Length of body 11 mm.; length of tegmina 10·4 mm.

There is really nothing to prevent the inclusion of this genus in the sub-family *Perisphæriinæ;* the sexual dimorphism debars it from occupying a natural position in the *Panchlorinæ.*

Sub-fam. *CORYDIINÆ.*

54. *Corydia dasytoides*, Wlk.

Euthyrrapha dasytoides, Walker, l. c. p. 191 (1868).
Corydia tonkinensis, Kirby, A.M.N.H. (7) xi, p. 405 (1903).

♀. Amoy.

Walker regarded as a variety of this species, another species from Siam which is evidently quite distinct, being the same as *C. ænea*, Br.; it is a ♀ collected by Mouhot.

The genus *Corydia* includes five closely allied species, some of which may possibly be regarded later as mere geographical races of one species; unfortunately the insects are rare in collections and additional examples are required before the exact relationships that they bear one to another can be elucidated. The following key will help in the identification of the species.

1. Tegmina crossed by an orange band.
   2. The band interrupted . . . . *purpuralis*, Kirby (S. W. Fokien)
   2′. The band not interrupted . . . . . *dasytoides*, Wlk. (Amoy, Tonkin)

1′. Tegmina not crossed by an orange band but with an orange costal patch.
   2. Apex of tegmina yellow . . . . *hilaris*, Kirby (Hab. ?)
   2′. Apex of tegmina not yellow.
      3. Abdomen orange with blue tip . . *cærulea*, Shelf. (Borneo)
      3′. Abdomen blue-black with marginal orange vittæ . . . . *ænea*, Br. (Burma)

55. *Euthyrrhapha ipscides*, Wlk.

Euthyrrhapha ipsoides, Walker, l. c. 191 (1868).

♂. Para, Brazil.

A synonym of the widely-distributed *E. pacifica*, Coq.

56. *Holocompsa debilis*, Wlk.

Holocompsa debilis, Walker, l. c. p. 192 (1868).

♀. Sarawak (*Wallace*).

The only Oriental representative of the genus.

57. *Dyscologamia pilosa*, Wlk.

Zetobora pilosa, Walker, l. c. p. 187 (1868).

♂. Java.

Allied to *D. capucina*, Br. but larger, more rufous, pronotum anteriorly more cucullate, tegmina with only one hyaline spot in the basal third.

58. *Dyscologamia silphoides*, Wlk.

Polyphaga silphoides, Walker, l. c. p. 182 (1868).

♀. Cambodia (*Mouhot*).

Much larger than *D. capucina*, Br. ♀, otherwise very similar, so far as can be gathered from the description of that species.

Sub-fam. *OXYHALOINÆ*.

59. *Chorisoneura fragilis*, Wlk.

Blatta fragilis, Walker, l. c. p. 218 (1868).

♂. Brazil.

Synonymous with *C. nigrifrons*, Serv.

60. *Chorisoneura glabricula*, Wlk.

Blatta glabricula, Walker, l. c. p. 218 (1868).

♂. Brazil.

Synonymous with *C. discoidalis*, Burm.

61. *Chorisoneura calogramma*, Wlk.

Blatta calogramma, Walker, l. c. p. 217 (1868).

♀. Brazil.

Occiput, vertex, and centre of frons dark castaneous, a testaceous band between the eyes, traversed by a narrow black line, rest of head testaceous; antennæ testaceous, the basal joints fuscous above. Pronotum transversely elliptical, all the margins hyaline, the disc castaneous with two large semilunar markings, testaceous. Tegmina clear hyaline, the veins testaceous, veins of discoidal area oblique, reticulated. Abdomen beneath testaceous, margined with fuscous; cerci testaceous. Legs testaceous.

62. *Prosoplecta quadriplagiata*, Wlk.

Prosoplecta quadriplagiata, Walker, l. c. p. 189 (1868).

♂. Batchian (*Wallace*).

63. *Prosoplecta gutticollis*, Wlk.

Prosoplecta gutticollis, Walker, l. c. p. 189 (1868).

♀. Ceram (*Wallace*).

In this species the sub-genital lamina is relatively enormous occupying nearly half the total length of the abdomen.

64. *Prosoplecta trifaria*, Wlk.

Prosoplecta trifaria, Walker, l. c. p. 190 (1868).
Prosoplecta megaspila, Walker, l. c. p. 190 (1868).

♂. (*trifaria*). Batchian (*Wallace*).
♀. (*megaspila*). Batchian (*Wallace*).

Sub-fam. *PERISPHÆRIINÆ.*

65. *Aptera rubricosa*, Wlk.

Nauphœta rubricosa, Walker, l. c. p. 185 (1868).

♂. S. Africa.

Synonymous with *A. cingulata*, Burm.

66. *Perisphæria flexicollis*, Wlk.

Zetobora flexicollis, Walker, l. c. p. 187 (1868).

♂. Singapore (*Wallace*).

This may well be the male of one of the Indo-Malayan species that have been described from female examples only. It is apparently most closely allied to *P. fornicata*, Br. from Burma, but is larger.

Total length 25 mm.; length of body 22 mm.; length of tegmina 19 mm.; pronotum 7 mm. × 10 mm.

67. *Hostilia cervina*, Wlk.

Zetobora cervina, Walker, l. c. p. 186 (1868).
? *Zetobora congrua*, Walker, l. c. p. 49 (1868).
Zetobora carinata, de Saussure, Mél. Orth. iv, p. 139, Pl. x, f. 50 (1873).

♂. Natal.

68. *Hyposphæria leucopthalma*, Wlk.

Zetobora leucopthalma, Walker, l. c. p. 186 (1868).

♂. Natal.

According to Kirby, who has compared the types, this is synonymous with *H. tenebrosa*, Wlk., a species placed by Walker in the genus *Panchlora!* It is somewhat doubtful if *tenebrosa*, Wlk. is not the same as *H. stylifera*, Br., but the wings are different in colour, and I hesitate to merge the species without comparing the types. *H. ruficornis*, Sss. and Zhnt. is also closely allied but can be distinguished by the colour of the antennæ.

69. *Blepharodera pilipes,* Wlk.
Panchlora pilipes, Walker, l. c. p. 184 (1868).

♂. Cape of Good Hope.

According to Kirby, who has compared the types, this is the equivalent of *B. contusa,* Wlk. (l. c. p. 30, 1868), and it is probable that it is synonymous with *B. pilifera,* Stål, the description of which is rather brief.

70. *Hormetica subcincta,* Wlk. (Plate XXX, fig. 8.)
Brachycola subcincta, Walker, l. c. p. 188 (1868).

♂. Colombia.

Allied to *H. verrucosa,* Br. Head testaceous with a large black marking on the front, extending to base of clypeus ; labrum, palpi and antennæ fusco-castaneous. Pronotum as in *H. verrucosa* but not bordered with black. Tegmina short, transversely truncate, not extending beyond the second abdominal segment, colour and markings as in *H. verrucosa.* Abdomen black, bordered above with testaceous, supra-anal lamina testaceous, sub-genital lamina rufo-castaneous, cerci black tipped with testaceous.

Total length 31 mm. ; length of tegmina 9 mm. ; pronotum 12 mm. × 18 mm.

The female has the abdomen above coloured as in the male, whereas in *H. verrucosa,* Br. ♀, the abdomen has transverse testaceous bands above and marginal testaceous spots below. The species varies considerably in size.

71. *Hormetica interna,* Wlk.
Brachycola interna, Walker, l. c. p. 188 (1868).

♂. Nauta (*Bartlett*).

Allied to the preceding species but the head not so heavily marked with black, the pronotum more punctate, the tegmina with a large semicircular band castaneous in colour, abdomen beneath margined with testaceous.

Total length 27 mm. ; length of tegmina 11 mm. ; pronotum 10 mm. × 15 mm.

Of the seventy-seven species in Mr. Saunders' collection described by Walker, fifty-seven can stand as distinct species

the remainder must be sunk as synonyms of previously described species; one of Walker's species it has been found necessary to separate into two. The following table gives the revised nomenclature of these species, which are now arranged in the order adopted by Walker in his "Catalogue of Blattidæ":—

Walker's Nomenclature.	Revised Nomenclature.
Polyphaga silphoides	*Dyscologamia silphoides*, Wlk.
Panchlora pilipes	*Blepharodera contusa*, Wlk.
Nauphœta guttulosa	*Tribonium guttulosum*, Wlk.
Nauphœta rubricosa	*Aptera cingulata*, Burm.
Zetobora leucopthalma	*Hyposphæria tenebrosa*, Wlk.
Zetobora cervina	*Hostilia cervina*, Wlk.
Zetobora flexicollis	*Perisphæria flexicollis*, Wlk.
Zetobora pilosa	*Dyscologamia pilosa*, Wlk.
Brachycola interna	*Hormetica interna*, Wlk.
Brachycola subcincta	*Hormetica subcincta*, Wlk.
Prosoplecta quadriplagiata	*Prosoplecta quadriplagiata*, Wlk.
Prosoplecta gutticollis	*Prosoplecta gutticollis*, Wlk.
Prosoplecta trifaria	*Prosoplecta trifaria*, Wlk. ♂.
Prosoplecta megaspila	*Prosoplecta trifaria*, Wlk. ♀.
Euthyrrapha dasytoides	*Corydia dasytoides*, Wlk.
Euthyrrapha dasytoides, var.	*Corydia ænea*, Br.
Euthyrrapha ipsoides	*Euthyrrapha pacifica*, Coq.
Holocompsa debilis	*Holocompsa debilis*, Wlk.
Stenoblatta parallela	*Stenoblatta parallela*, Wlk.
Epilampra polyspila	*Molytria maculata*, Br.
Epilampra inclarata	*Epilampra inclarata*, Wlk.
Epilampra conformis	*Pseudophoraspis nebulosa*, Burm.
Epilampra scita	*Pseudophoraspis nebulosa*, Br.
Epilampra plena	*Epilampra plena*, Wlk.
Epilampra fervida	*Epilampra plena*, Wlk.
Epilampra dotata	*Molytria badia*, Br.
Epilampra varia	*Epilampra varia*, Wlk.
Epilampra adusta	*Homalopteryx adusta*, Wlk.
Epilampra basifera	*Homalopteryx macassariensis*, Haan.
Epilampra ramifera	*Molytria ramifera*, Wlk.
Epilampra parvicollis	*Hedaia parvicollis*, Wlk.
Epilampra concinnula	*Hedaia concinnula*, Wlk.
Pseudomops inclusa	*Pseudomops inclusa*, Wlk.
Pseudomops scutigera	*Pseudothyrsocera scutigera*, Wlk.
Pseudomops fissa	*Hemithyrsocera histrio*, Burm.
Pseudomops pica	*Pseudothyrsocera pica*, Wlk.
Ellipsidium speciosum	*Thyrsocera speciosa*, Wlk.
Blatta calogramma	*Chorisoneura calogramma*, Wlk.
Blatta fragilis	*Chorisoneura nigrifrons*, Serv.
Blatta glabricula	*Chorisoneura discoidalis*, Burm.
Blatta annulicornis	*Phyllodromia annulicornis*, Wlk.
Blatta erythrina	*Ischnoptera rufa*, Br.
Blatta extenuata	*Phyllodromia supellectilium*, Serv.

Walker's Nomenclature.	Revised Nomenclature.
Blatta colligata	*Phyllodromia colligata*, Wlk.
Blatta polygrapha	*Phyllodromia polygrapha*, Wlk.
Blatta suffusa	*Phyllodromia suffusa*, Wlk.
Blatta amplectens	*Phyllodromia amplectens*, Wlk.
Blatta hamifera	*Phyllodromia hamifera*, Wlk.
Blatta ignobilis	*Phyllodromia ignobilis*, Wlk.
Blatta funebris	*Phyllodromia funebris*, Wlk.
Blatta palpalis	*Duryodana palpalis*, Wlk.
Blatta obtusifrons	*Phyllodromia obtusifrons*, Wlk.
Blatta elegans	*Phyllodromia elegans*, Wlk.
Blatta apicigera	*Theganopteryx apicigera*, Wlk.
Blatta propinqua	*Phyllodromia propinqua*, Wlk.
Blatta contigua	*Phyllodromia propinqua*, Wlk.
Blatta contingens	*Phyllodromia contingens*, Wlk. ♀.
Blatta sequens	*Phyllodromia sequens*, Wlk.
Blatta guttifera	*Phyllodromia guttifera*, Wlk.
Blatta xanthopila	*Pseudothyrsocera xanthophila*, Wlk.
Blatta laterifera	*Phyllodromia laterifera*, Wlk.
Blatta virescens	*Phyllodromia virescens*, Wlk.
Blatta majuscula	*Phyllodromia majuscula*, Wlk.
Blatta marmorata	*Phyllodromia marmorata*, Wlk.
Blatta humeralis	*Phyllodromia contingens*, Wlk. ♂.
Blatta picticollis	*Phylodromia picticollis*, Wlk.
Blatta bipunctata	*Pseudectobia bipunctata*, Wlk.
Blatta laticeps	*Pseudophyllodromialaticeps*, Wlk.
Blatta circumducta	*Escala circumducta*, Wlk.
Blatta longiuscula	*Escala longiuscula*, Wlk.
Blatta patula	*Allacta mundicola*, Wlk. ♀.
Blatta latirupta	*Allacta mundicola*, Wlk. ♂.
Ischnoptera reversa	*Ischnoptera reversa*, Wlk.
Ischnoptera conferta	*Leucophæa conferta*, Wlk.
Ischnoptera ? obliqua	*Pinaconota obliqua*, Wlk.
Ischnoptera ? punctosa	*Oniscosoma punctosa*, Wlk.
Periplaneta aterrima	*Pelmatosilpha aterrima*, Wlk.
Periplaneta oculata	*Methana oculata*, Wlk.

VI. Viviparity amongst the *Blattidæ*.

Attention was first called to this phenomenon amongst the *Blattidæ* by Riley ("Insect Life," vol. iii, p. 443, 1890–1891 and vol. iv, p. 119, 1892), who observed it in *Panchlora viridis*, Burm. Scudder had already noted (Psyche, vol. v, p. 405, 1890) the occurrence of a female specimen of *Panchlora nivea*, L., found alive in a bath-room at Salem, Mass., surrounded by numerous newly-hatched young, but he had not been able to demonstrate the actual birth of these young. Riley dissected one of

his specimens and found that it contained a perfect egg-cluster of crescentic form, the eggs to the number of forty-four and in different stages of development being arranged in a double row. The egg-mass was contained in a thin-walled prolongation of the genital pouch, which may be termed the brood sac. Whilst in most cockroaches the egg-capsule is a horny structure, in *Panchlora viridis* it is a fine membranous sheath enclosing only the basal half of the egg-mass. The colleterial glands have always been regarded as secreting the substance of the horny ootheca of *Blattidæ,* and Riley assumed that they are absent or much reduced in *Panchlora viridis* but did not test the truth of his assumption by dissection. From another specimen examined by Riley young larvæ and nearly mature embryoes had been extruded.

Holmgren in a paper on viviparity amongst insects in general (Zool. Jahrb. Syst. xix, p 434,) records viviparity for three more genera of *Blattidæ,* viz. *Eustegasta micans,* Sss. and Zhnt., *Oxyhaloa saussurei,* Borg, and an undetermined species of *Blabera.* In the latter species the developing eggs are contained in a horny and sculptured capsule which lies in a thin-walled brood-sac and is apparently retained there till the eggs are mature or nearly so. In *Eustegasta micans* the ootheca splits open whilst still in the brood-sac, and the young larvæ emerge two by two from the mother. Holmgren divides *Blattidæ* into three sections according to their method of reproduction, as follows:—

1. Oviparous species, which carry the ootheca for some days protruding from the tip of the abdomen.
Ex. *Periplaneta.*

2. Viviparous species, the ootheca retained within a brood-sac.
Ex. *Eustegasta, Oxyhaloa, Blabera.*

3. Viviparous species, the ootheca practically absent.
Ex. *Panchlora.*

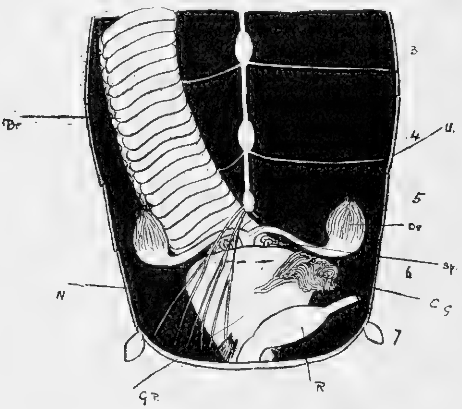
To this last section and possibly to the second I am able to add more examples.

My own attention was specially drawn to this phenomenon of viviparity amongst *Blattidæ* in rather an interesting manner. Whilst arranging the South

American species of *Epilampra* in the Hope Museum, Oxford, I had occasion to examine closely a series of specimens of *Epilampra burmeisteri*, Guér., collected in Brazil by the distinguished traveller, W. J. Burchell, and I observed that one female example had been preserved with two young larvæ actually emerging from the tip of the abdomen, and that they were still partially shrouded in some shreds of the embryonic membranes. The specimen is numbered "1400" and is the only one of the series that does bear a number. Those who have had occasion to study Burchell's collections know that he attached numbers to the specimens that were of special interest to him and his observations on such specimens were recorded in his note-books under corresponding numbers. Unfortunately Burchell's note-books with records of specimens numbered from 1345 onwards are lost, but we can be tolerably sure that the young larvæ emerging from the abdomen of his specimen No. 1400 did not escape the notice of this keen observer and that the specimen was consequently numbered and the fact actually recorded. To Burchell then may well be accorded the credit of first discovering the phenomenon of viviparity in *Blattidæ.*

In Sarawak, Borneo, I captured a female of *Pseudophoraspis nebulosa*, Burm., with numerous young larvæ clinging to the under surface of the abdomen, and in the Hope Museum is a female of *Phlebonotus pallens*, Serv., with the following label attached:—"Ceylon. J. Staniforth Green. Carries its live young beneath its wing-covers. 1878." In the females of this species the tegmina are large and convex, the wings somewhat reduced and the abdomen above is concavely depressed, so that a brood-chamber is formed under the tegmina in which there is ample room to accommodate several young larvæ. It is hardly reasonable to suppose that these two species of *Epilamprinæ* deposit an ootheca containing newly-fertilized eggs and stay beside the ootheca until the young larvæ hatch out and return to the mother from whom they originated. It is, on the contrary, in the highest degree probable that the eggs are retained in the body of the mother until they attain maturity, but whether they are enclosed in a horny ootheca lying in a brood-sac or whether the ootheca is absent or much reduced as in *Panchlora viridis* is not known. I have dissected the female *Pseudophoraspis nebulosa* that I captured with her

young and find that below the genital pouch lies a forward prolongation of it with rather thick walls; this is the brood-sac and as it is not much larger than the genital pouch itself and much smaller than the brood-sac in *Panchlora viridis* and in *Molytria maculata* and *Panesthia javanica*, as described below, it is rather difficult to explain its function, unless one supposes that it becomes very much dilated as the fertilized eggs pass into it from the uterus, its walls then becoming membranous and the whole organ pushing forward to lie amongst the abdominal viscera as is the case in other viviparous species. The brood-sac was empty in the specimen examined; the genital pouch



Dissection of *Panesthia javanica*, ♀, showing brood-sac, etc.

3–7 = Nos. of segments.
R. = Rectum.
G.P. = Genital pouch.
C.G. = Colleterial gland.
Sp. = Spermatheca.
U. = Uterus.
Ov. = Ovary.
Br. = Brood-sac.
N. = Branches of ventral nerve-cord.

had thick muscular walls, and when opened the four finger-like gonapophyses were seen attached to the dorsal wall and directed backwards; in the ventral wall was seen the orifice leading to the brood-sac and lying at the bottom of a depression in the wall of the pouch. The right colleterial gland was well developed, but the left one was aborted.

In *Panesthia javanica*, Serv., the egg-mass, which is about 18 mm. long, is contained in a thin-walled brood-sac lying asymmetrically on the left side of the abdomen

and extending as far forward as the third abdominal sternite; this brood-sac is, as in the other viviparous species, connected with the genital pouch. The eggs number from 36 to 40 and are retained in the brood-sac until mature; they do not form a crescentic mass as in *Panchlora viridis.* The left colleterial glands are absent, but those on the right are well developed. It is by no means clear that these glands secrete the chitinous ootheca of *Periplaneta*, etc.; it is remarkable to find that on one side at least they are well developed in a species whose eggs are enclosed in a thin membrane. I have not been able to dissect *Molytria maculata*, Br., as I have nothing but dried specimens, but I have frequently removed egg-masses in all stages of development from the brood-sacs of freshly-killed females during my sojourn in the Eastern tropics and I have several of these egg-masses in my possession now; they are larger than those of *Panesthia javanica*, but otherwise show no differences worth considering at present. I hope ere long to study the embryonic development of these two viviparous genera *Panesthia* and *Molytria;* it is possible that it differs considerably from that of oviparous species. Viviparity is now known to occur in six of the eleven sub-families of *Blattidæ*, viz. *Epilamprinæ* (4 genera), *Panchlorinæ*, *Blaberinæ*, *Oxyhaloinæ*, *Perisphæriinæ*, *Panesthiinæ* (one genus each), and is consequently of more usual occurrence than was suspected; I think it likely that it will be shown eventually that it occurs almost, if not quite, universally amongst the *Epilamprinæ*. *Eustegasta* is a genus placed by all authors in the *Perisphæriinæ*, but in the majority of its characters it is much more closely allied to the *Epilamprinæ* than to the other members of the *Perisphæriinæ* and it is of interest that viviparity occurs in this genus.

NOTE.—Just before going to press I received alive a female specimen of *Panchlora virescens*, Thunb., and some females of *Phyllodromia germanica*, L. Mr. H. Main, to whom I am indebted for the latter specimens, informs me that *P. germanica* ♀ carries the egg-capsule protruding from the tip of the abdomen for some weeks and deposits it only one or two days before the contained young hatch out. I was surprised to observe in the living female of *Panchlora virescens* an egg-mass partially protruding from the end of the abdomen; so far as can be determined

by a superficial examination the eggs are not in a very advanced state of development; in this specimen the egg-mass is so large that it cannot be retained entirely in the brood-sac; the ootheca is represented by a thin transparent membrane, which however is complete, not incomplete as in the species observed by Riley. In an undescribed species of *Temnopteryx* from East Africa, the female carries the eggs contained in a transparent membrane protruding from the end of the abdomen; in the only example examined the eggs are very advanced in development. These new facts enable me to modify Holmgren's "series" of *Blattidæ* as follows:—

1. Oviparous species. Eggs enclosed in a chitinous ootheca and carried by the female for a short time only.
   Ex. *Ectobia, Blatta, Periplaneta.*

2. Ovo-viviparous species. (*a*) Eggs enclosed in a semi-chitinous capsule and carried by the female, protruding from the abdomen during the greater part of the embryonic period.
   Ex. *Phyllodromia germanica.*

   (*b*) As above, but eggs enclosed in a transparent membrane.
   Ex. *Temnopteryx* sp.

3. Viviparous species. (*a*) Eggs enclosed in a chitinous ootheca which is retained in the brood-sac of the mother. Ex. *Oxyhaloa saussurei, Eustegasta micans, Blabera* sp. [? *Pseudophoraspis nebulosa* and *Phlebonotus pallens*]. (*b*) Eggs enclosed in a transparent membrane, which is retained in the brood-sac of the mother. i. Membrane complete. Ex. *Molytria maculata, Epilampra burmeisteri, Panchlora virescens, Panesthia javanica* [? *Pseudophoraspis nebulosa* and *Phlebonotus pallens*]. ii. Membrane incomplete. *Panchlora viridis, P. nivea.*

VII. A New Genus of Symbiotic *Blattidæ.*

Genus *Sphecophila*, nov.

Superficially resembling *Attaphila*, Wheel., but tegmina absent in the male ; subgenital lamina of male provided with two styles ; femora unarmed beneath ; no arolia between tarsal claws ; frons swollen ; eyes reduced ; ocelli present ; antennæ short, but conforming to normal Blattid type.

The only known species was taken from the nest of the wasp, *Polybia pygmæa*, Fab., in French Guiana.

We have in this little cockroach an example of the difficulties which beset the systematist when he has to deal with aberrant species modified by peculiar habits and environment to a similar general facies.

The genus *Attaphila* contains two species of myrmecophilous cockroaches, *A. fungicola*, Wheel., and *A. bergi*, Bol., found respectively in the nests of *Atta fervens*, Say, in Texas, and *Atta lundi*, Guèr., in Uruguay. Wheeler, who first made known the genus (Amer. Nat. vol. xxxiv, p. 851, 1900), suggests that among the Blattidæ it occupies "a peculiar if not unique taxonomic position ;" and Bolivar (Comm. del. Mus. Nac. d. Buenos Aires, p. 333, 1901) creates for its reception the sub-family Attaphilinæ, regarding the peculiar antennal characters of high importance. This sub-family takes its place in the first of the two great divisions in which the Blattidæ have been brigaded, viz. that in which the femora are spined beneath. *Sphecophila* cannot be placed in this division, for the femora are unarmed beneath ; much less then can it be placed in the sub-family Attaphilinæ, though its general resemblance to *Attaphila* is most striking. Must then a new sub-family be created for the reception of *Sphecophila ?* I think not ; the multiplication of sub-divisions for the reception of anomalous genera is a practice to be deprecated for many reasons, chief among which is the consideration that it tends to obscure the relationships which must exist between these anomalous genera and genera of more normal type. In my opinion *Attaphila* may be regarded as an aberrant Phyllodromiine, akin to *Loboptera*, Br., or *Temnopteryx*, Br., and *Sphecophila* as an aberrant member

of the sub-family Corydiinæ (= Heterogamiinæ). Bolivar (l. c.) is much impressed by the structure of the antennæ in *Attaphila*, the increasing lengths of the joints in proportion to their breadth particularly attracting his attention, and he states that in all other Blattidæ the joints of the antennæ, with the exception of the first, are short and transverse. This as a matter of fact is scarcely accurate; in cockroaches of normal type the first joint of the antennæ is longer than broad, the second usually broader than long, and the third much longer than broad; the succeeding joints are short and transverse but gradually increasing in length until they are longer than broad, and the apical joints are usually sub-moniliform. *Attaphila* is peculiar in that the third joint of the antennæ is short and transverse and the increase in length of the succeeding joints is not gradual but sudden. Unfortunately in all the specimens of *Attaphila* that have been examined, the antennæ are mutilated, so we know nothing of the terminal ends of these organs. Wheeler examined forty-five examples of *A. fungicola*, and found that in seventeen specimens the mutilation of the antennæ was symmetrical, in twenty-one specimens almost symmetrical, the difference being not more than one joint; in only seven specimens were the antennæ very asymetrically mutilated. He concludes that the ants, with which this cockroach lives, crop the antennæ of their guests and suggests that the peculiar structure of the antennæ is a result of continual clipping. Without subscribing to this opinion, it may be pointed out that a modification of the antennæ of an insect living in the dark and under very peculiar circumstances is rather to be expected; indeed, it might be expected that profound modifications of the antennæ would invariably accompany a marked reduction of the other sense-organs, the eyes, if *Sphecophila* was not a standing proof to the contrary. *Attaphila*, as shown by an examination of the contents of the alimentary canal, feeds on the fungus cultivated by the leaf-cutting ants; *Sphecophila* is nourished otherwise. The wasps of the genus *Polybia* construct small paper nests pendant from the under surface of leaves or twigs; in some species the nest is made up of a number of cells without any outer common covering; every cell containing a larva is open at the lower end, and it is only the cells containing nymphs that are closed, each with a paper cap. *Polybia pygmæa* however constructs a nest composed of a

number of cells enclosed in a common covering of paper, and the entrance to the nest is by one orifice in the floor of the nest. The mother wasp feeds the larvæ with insects or spiders that she brings to them, and it is probable that the symbiotic cockroaches living on the floor of the nest feed on any small fragments of food that may drop down from the wasp-larvæ in the cells above. I owe this suggestion to my friend Vicomte R. du Buysson, who discovered the cockroaches in the nest of the *Polybia*, which was sent home by the collector, M. F. Geay. In conclusion, we may regard these two genera, *Attaphila* and *Sphecophila*, as affording an admirable demonstration of convergence in development, a result which we may fairly assume to have been brought about by very similar modes of life, viz. symbiosis with social Hymenoptera. The following tables show more graphically the similarities between the two genera and their dissimilarities, and it will be seen that whilst the former are in the main superficial and obvious, the latter are deep-seated and of great taxonomic importance, showing that the genera have arisen from totally different stocks.

Features common to the two genera:—

Colour.
Pubescence.
Size.
Shape.
Reduction of eyes.
Vertex not covered by pronotum.
Shortness of legs.
One-jointed cerci.

Differences between the two genera:—

ATTAPHILA. ♂.	SPHECOPHILA. ♂.
Third antennal joint short.	Third antennal joint long.
Ocelli absent.	Ocelli present.
Tegmina and wings present.	Tegmina and wings absent (? in nymphs only).
Supra-anal lamina trigonal.	Supra-anal lamina semi-orbicular.
Styles absent.	Styles present.
Femora armed beneath.	Femora unarmed beneath.
Tarsal arolia present.	Tarsal arolia absent.

Sphecophila polybiarum. (Plate XXX, figs. 10–12.)

♂. Fulvo-testaceous, with a fine fulvous pubescence. Vertex not covered by the pronotum; front of head swollen and projecting as is common amongst the Corydiinæ; eyes very much reduced, scarcely visible from the front and almost entirely hidden under the deflexed sides of the pronotum; one pair of true ocelli situated low down on the frons and closer together than the antennal sockets; maxillary and labial palpi small. Antennæ short, of twenty joints, the first joint longer than broad, the second as broad as long, the third longer than broad, the remaining joints at first broader than long, but gradually becoming longer, the last four or five joints almost moniliform. Pronotum with anterior and posterior margins truncate, narrower in front than behind, longer than broad, sides deflexed; meso- and metanotum broader than long, their posterior angles only slightly produced backwards. Nine abdominal tergites, including the supra-anal lamina, are visible, posterior margins of the first three and of the eighth straight, of the fourth to the seventh concave; the supra-anal lamina is semi-orbicular. Cerci one-jointed, acute, equal to the supra-anal lamina in length. Eight abdominal sternites, including the sub-genital lamina, are visible; sub-genital lamina slightly produced, not extending as far as the supra-anal lamina, with one pair of styles equalling in length the cerci and clothed with a few erect hairs. Femora without spines, on the anterior margin beneath of the front femur is a row of stiff setæ, a genicular spine on each femur, no apical spines. Spines on tibiæ above in three rows, five apical spines on the posterior tibiæ. Metatarsus longer than the remaining joints, no arolium between claws.

♀ unknown.

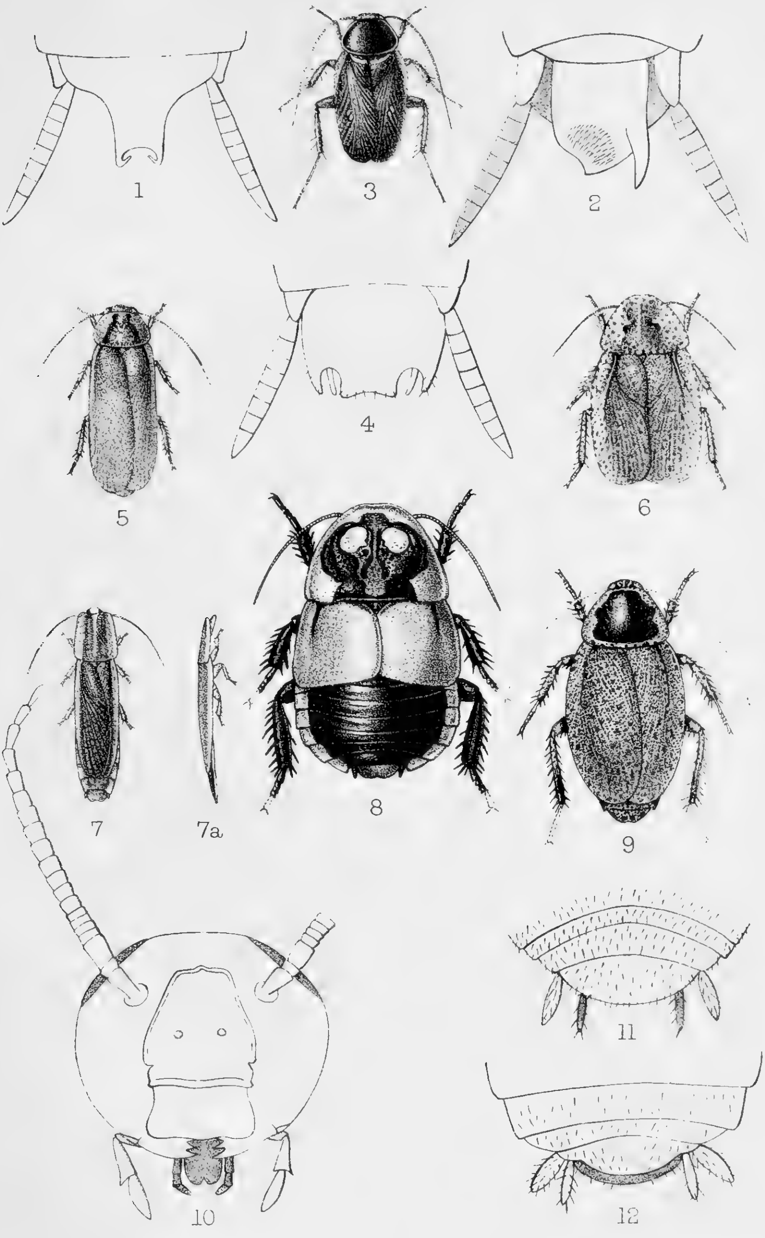
Total length 3 mm. – 3·2 mm.

Ste. Marie, Oyapock, French Guiana (F. Geay, 1900). Ten examples (Paris Museum); from the nest of *Polybia pygmæa*, Fab.

The absence of female examples is striking, but it is possible that the entire colony was not secured by the collector, some individuals may have escaped from the nest. I cannot be certain that the specimens here described are fully adult, but I am inclined to think that they are, or if not, that the adults are apterous, for nymphs of winged cockroaches have the posterior angles of the mesonotum and metanotum much more strongly produced backwards than is the case in the specimens before me.

EXPLANATION OF PLATE XXX.

FIG. 1. Supra-anal lamina of *Pseudothyrsocera xanthophila*, Wlk., ♂.
2. Sub-genital lamina of *Pseudothyrsocera xanthophila*, Wlk., ♂.
3. *Pseudectobia bipunctata*, Wlk., ♀ × 3.
4. Sub-genital lamina of *Phyllodromia contingens*, Wlk., ♂.
5. *Pinaconota obliqua*, Wlk., ♂. Slightly enlarged.
6. *Homalopteryx adusta*, Wlk., ♀. Slightly enlarged.
7. *Stenoblatta paralella*, Wlk., ♀. Slightly enlarged.
a. side view.
8. *Hormetica subcincta*, Wlk., ♀. Slightly enlarged.
9. *Epilampra varia*, Wlk., ♀. Slightly enlarged.
10. Head of *Sphecophila polybiarum*, mihi, ♂ × 35.
11. Supra-anal lamina of *Sphecophila polybiarum*, mihi, ♂ × 25.
12. Sub-genital lamina of *Sphecophila polybiarum*, mihi, ♂ × 25.



H. Knight del. et lith. West, Newman imp.

TYPES OF BLATTIDÆ.

XXVI. *Studies of the* Blattidæ. By R. Shelford, M.A., F.L.S.

[Read December 4, 1907.]

VIII. The Blattidæ described by Linnæus, De Geer and Thunberg.

Stål published in 1873, 1874, and 1875 the three parts of his "Recensio Orthopterorum. Revue critique des Orthoptères décrits par Linné, De Geer et Thunberg." The families treated in this memoir, which is not only a critical review but a revision of genera also, are the Acridiidæ, Locustidæ, Gryllidæ and Phasmidæ. Stål relinquished the idea of treating the Mantidæ and Blattidæ in the same way, though in 1877 he published his "Systema Mantodeorum," and this contains all the information necessary for the correct determination of the scanty number of species described by the older Swedish entomologists. The Blattidæ have long been neglected, and since the exact determination of the species described by the older authors is, in any systematic work on any group of insects, a matter of first-rate importance, if not an actual necessity, I made it the first object of a visit to Sweden last summer to examine in detail the Blattidæ in the collections of De Geer at Stockholm and of Thunberg at Uppsala. The collection of Queen Louisa Ulrica now at Uppsala contains only three species of Blattidæ described by Linnæus, and I assumed that the remainder of his types were in the possession of the Linnæan Society of London. However, on looking over this collection recently I found that such was by no means the case, and for reasons given below I believe that with one exception those types of Blattidæ described by Linnæus, which are not at Uppsala nor in London, are in De Geer's collection at Stockholm. In my investigations I have received the kindest assistance from Dr. Daydon Jackson, Prof. Chr. Aurivillius, Dr. Y. Sjöstedt and Dr. Ivar Trägårdh, to all of whom I beg to offer my cordial thanks.

i. Species described by Linnæus.

The Linnæan species are twelve in number, viz. :—

1.	*Blatta gigantea*,	Syst. Nat. (ed. x) i, p. 424,	No. 1 (1758).
2.	„ *ægyptiaca*,	op. cit.	No. 2.
3.	„ *surinamensis*,	„ „	No. 3.
4.	„ *americana*,	„ „	No. 4.
5.	„ *nivea*	„ „	No. 5.
6.	„ *africana*	„ „	No. 6.
7.	„ *orientalis*,	„ „	No. 7.
8.	„ *lapponica*,	„ „	No. 8.
9.	„ *oblongata*,	„ „	No. 9.
10.	*Cassida petiveriana*,	„ „	p. 364, No. 18.
11.	„ *7-guttata*,	Syst. Nat. (ed. xii) i (2), p. 577,	No. 19 (1767).
12.	*Blatta germanica*,	op. cit.	p. 668, No. 7.

With the exception of *nivea* and *oblongata* all the species have been determined with accuracy by subsequent authors.* *Petiveriana* and 7-*guttata*, originally described as Coleoptera, are synonymous. As regards the types, *gigantea*, *ægyptiaca* and *africana* represented by unique male specimens are in the Queen Ulrica collection at Uppsala. The Linnæan Society's collection of insects contains a number of Blattidæ, but only five of these can be identified by the labels in Linnæus' handwriting as his types, viz., *lapponica* (1 ♂, 1 ♀), *germanica* (1 ♂), *orientalis* (1 ♂), *petiveriana* (1 ♂) and 7-*guttata* (♀). The other species were added subsequent to the purchase of the Linnæan cabinet and bear labels in various handwritings; moreover the collection includes no species that can possibly be identified with *oblongata* and *nivea*. The types of four species have still to be accounted for, viz. *surinamensis*, *americana*, *nivea* and *oblongata*. I have some reason for believing that these are in De Geer's collection. De Geer in his "Mémoires pour servir à l'histoire des insectes," vol. iii (1773), enumerates twelve species of Blattidæ, six of which he describes as new and

* Brunner however in his "Nouveau Système des Blattaires," p. 357 (1865), identifies *Polyphaga ursina*, Burm., with *africana* L., which is incorrect, for the species are very different.

six of which are Linnæan species, Linnæus' descriptions in full being prefixed to his own descriptions. Of these six Linnæan species he records two as occurring in Russia, Finland and Sweden, viz. *orientalis* and *lapponica;* the other four correspond with the missing Linnæan types, viz. *surinamensis, americana, nivea* and *oblongata.* The coincidence is arresting, and I have looked into the matter more closely to see if it is something more than mere coincidence. In the first place we may assume with some degree of confidence that the two local species of Blattidæ, *lapponica* and *orientalis,* were the first to attract the attention of Swedish naturalists and formed the nucleus of collections of these insects; consequently to find specimens of them in the cabinets both of Linnæus and De Geer is not surprising. De Geer received, as he states in his book, insects from Surinam, sent to him by his correspondent Rolander: is it not probable that at first he lent these for description to his friend Linnæus who he knew to be preparing new editions of his "Systema Naturæ," but that when later he wrote his own work on entomology he kept the specimens that arrived from Rolander and described them himself? Thus we find in De Geer's collection two common local species, ten exotic species, four of which were described by Linnæus in 1758, six by himself in 1773. The supposition that Linnæus described specimens from De Geer's collection becomes almost a certainty when we read in De Geer's description of *Blatta oblongata* (l. c., p. 541), "Cette petite Blatte que M. Rolander m'a encore envoyée de Surinam . . . ," and on turning to the Linnæan description of the species see that it ends with "*Habitat* in America. *Rolander.*" It is possible but not very probable that Rolander sent specimens of this species both to Linnæus and to De Geer, and as a matter of fact Dr. Daydon Jackson tells me that Linnæus somewhere laments that Rolander never gave him anything. That Linnæus and De Geer were on the most friendly terms is shown by the series of fifteen letters to Linnæus from De Geer, now in the possession of the Linnæan Society. Dr. Daydon Jackson has also drawn my attention to a passage in a translation of Linnæus' diary printed in Morton's edition of Pulteney's Linnæus: "Rolander collected in the islands near America a great many plants, which he gave to M. de Geer, Chamberlain of the Household, who made me a present of every one of

them." Whether my supposition that De Geer lent some of the specimens in his collection to Linnæus for description is correct—and it must be admitted that there is a degree of probability in its favour—or not, I would venture to suggest that the specimens of *surinamensis, americana* and *nivea* now in the De Geer cabinet be selected as the types of the Linnæan species; otherwise these species must remain without typical specimens, for if these specimens are not the actual types then the actual types are irrevocably lost. The specimen of *oblongata* in De Geer's cabinet cannot be chosen as the type of the species, for, though it is in a fragmentary condition, enough remains to show that it does not in the least correspond with the Latin diagnosis of Linnæus or with De Geer's description in French or with his figures. In other words, this is not the actual specimen on which both Linnæus and De Geer based their descriptions; that specimen must have been lost or destroyed accidentally, and the existing specimen subsequently placed under the same name, either by De Geer or perhaps still later by some one else. The discrepancy between the descriptions of *oblongata* and the existing specimen does not invalidate my view as to the identity of the Linnæan types, for the diagnosis of Linnæus tallies perfectly not only with De Geer's description but with his figure. It is noteworthy too that in the case of the other three species the Linnæan diagnoses agree perfectly with De Geer's specimens, figures and descriptions; the Latin diagnoses are of course much shorter than the French descriptions, which are therefore not mere translations, but additional and amplified diagnoses.

As to *oblongata* there seems nothing for it but to regard the species for the present as uncertain; it has not been recognised with accuracy since it was described, for the *Blatta oblongata* of Serville and the *Thyrsocera oblongata* of Brunner and de Saussure is quite a different insect, to be identified probably with the *Blatta intercepta* of Burmeister. The species described by Walker as *Pseudomops inclusa* (= *amœna* Sauss.) is evidently closely allied to *oblongata* L., and a long series of specimens might show that Walker's species was merely a varietal form of *oblongata*.

The other Linnæan species which had not been recognised with certainty by later authors, *Blatta nivea,* will be discussed in the next section of this paper.

ii. De Geer's Collection.

As already stated, De Geer in his "Mémoires pour servir à l'histoire des insectes," vol. iii (1773) enumerates twelve species of Blattidæ, six of which are described as new, viz.:—

Blatta pensylvanica.
Blatta abdomen-nigrum.
Blatta livida.
Blatta rufa.
Blatta grisea.
Blatta minutissima.

The remaining six species are Linnæan species, but new names are given to two, even though De Geer fully recognised the specific identity of his species with those of Linnæus.

The collection is now at Stockholm in the Riks Naturhistoriska Museum, and with the exception of one specimen is in a good state of preservation. I am indebted to Dr. Y. Sjöstedt for permission to make a careful examination of this very interesting collection. The following is a catalogue of the specimens with annotations:—

1. *Blatta culinaris*, De Geer, op. cit. p. 530, pl. 25, ff. 1–7.

This is the *Blatta orientalis* of Linnæus; 2 ♂♂, 1 ♀, and also 1 larva of *Pycnoscelus surinamensis*, L.

2. *Blatta lapponica*, De Geer, op. cit. p. 533, pl. 25, ff. 8–12.
= *Ectobius lapponicus*, L.
3 ♂♂.

3. *Blatta kakkerlac*, De Geer, op. cit. p. 535, pl. 44, ff. 1–3.
= *Periplaneta americana*, L.
1 ♂, 1 ♀.
From S. America (Rolander.)

4. *Blatta pensylvanica*, De Geer, op. cit. p. 537, pl. 44, f. 4.
= *Ischnoptera pensylvanica*, De Geer.
1 ♂.

The species has been recognised and correctly determined by all subsequent authors.

From "Pensylvania" (Acrelius).

5. *Blatta abdomen-nigrum*, De Geer, op. cit. p. 537, pl. 44, f. 5.
   = *Epilampra abdomen-nigrum*, De Geer (*syn. Epilampra brevis*, Brunner, P.Z.S. Lond., 1892, p. 203, pl. 15, f. 3).
   1 ♀.

The species is omitted in Kirby's "Synonymic Catalogue of Orthoptera."

Description of the type :—

♀. Rufo-testaceous shading to rufo-castaneous. Head with vertex between the eyes castaneous, rest of head rufo-testaceous with a few scattered brown points; width between the eyes slightly greater than length of first antennal joint. [Antennæ mutilated.] Pronotum trapezoidal, anteriorly truncate, posteriorly produced, sides deflexed; smooth, rufo-testaceous but densely covered with fine castaneous dots, lyrate markings faintly indicated. Tegmina just failing to reach base of supra-anal lamina, rufo-castaneous with a few scattered castaneous points; anal field with slight indications of seriate punctures; the part of the right tegmen overlapped by the left, dark castaneous; mediastinal vein forked at apex, radial vein bifurcate, dark castaneous at base, 12 costals from upper branch of radial, the lower branch multiramose. Abdomen above heavily mottled with castaneous, supra-anal lamina produced, triangular, apex notched, (slightly mutilated during life and regenerated on the right side), projecting beyond the sub-genital lamina. Spiracular tubes prominent. Abdomen beneath castaneous, sub-genital lamina produced, ample, posterior margin sinuate. [Cerci mutilated.] Coxæ rufo-testaceous, spotted with castaneous; femora rufo-testaceous with a castaneous line along the outside and lower aspect; tibiæ with apex and a line down the outer aspect castaneous. Front femora with a series of 5 spines on the anterior margin beneath, succeeded distally by a row of piliform setæ, 2 spines on the posterior margin, mid-femora with 4 spines on anterior margin and also on posterior margin beneath, hind-femora with 3 on anterior margin and 4 on posterior margin beneath. Formula of apical spines $\frac{2}{1}$, $\frac{1}{1}$, $\frac{1}{0}$, no genicular spines on front femora. Posterior metatarsus [one absent] has been regenerated and is composed of 4 joints only.

Total length 25·5 mm.; tegmina 18·1 mm.; pronotum 7 mm. × 8·4 mm.

The species is recorded from Surinam by De Geer;

there are examples in the Oxford Museum from Demerara, Guadeloupe and I. of St. Vincent.

6. *Blatta livida*, De Geer, op. cit. p. 538, pl. 44, f. 6.
   = *Epilampra abdomen-nigrum*, De Geer.
   1 ♂.

One example with the abdomen missing. From a comparison with specimens in the Oxford Museum, I am convinced that this species of De Geer's is merely the male of *E. abdomen-nigrum*. The differences between the two specimens are, irrespective of size, very trifling, e.g. in *Blatta livida*, the mediastinal vein is triramose, there are only 10 costals, the legs are testaceous, and there are only 4 spines on the anterior margin beneath of the front femora and 3 on both margins beneath of the other pairs.
Total length 19 mm.; tegmina 15 mm.; pronotum 5 mm. × 6·9 mm.

Also recorded from Surinam. The unique specimen bears a label in Stål's handwriting "Epilampra brasiliensis, Burm. var."

7. *Blatta rufa*, De Geer, op. cit. p. 539, pl. 44, f. 7.
   (*syn. Ischnoptera rufa*, Brunner.)
   1 ♂.

This species also is omitted in Kirby's Catalogue.

Description of the type:—

♀. Uniform rufo-castaneous. [Head missing.] Pronotum trapezoidal, anteriorly truncate, sides deflexed, posteriorly very obtusely angulated, smooth, with two oblique obsolescent impressions. Scutellum exposed. Tegmina and wings extending considerably beyond the apex of the abdomen; mediastinal vein simple, radial vein not bifurcate, 16–18 costals, 11 longitudinal discoidal sectors, both the ulnar veins being ramose, the sectors connected by numerous transverse venulæ. Supra-anal lamina triangularly produced, its apex hyaline, exceeding the sub-genital lamina in length, sparsely fimbriate. Abdomen beneath castaneous, sub-genital lamina semi-orbicular, ample. [Cerci mutilated.] Legs testaceous, tibiæ rather darker than femora. Front femora with 4 spines on anterior margin, succeeded distally by piliform setæ, one spine on posterior margin beneath; mid and hind femora with 4 spines on both margins

beneath. Formula of apical spines $\frac{3}{1}$, $\frac{1}{1}$, $\frac{1}{1}$, no genicular spines on front femora.

Total length 21 mm.; body-length 13·5 mm.; tegmina 17 mm.; pronotum 4·1 mm. × 5·5 mm.

From Surinam.

8. *Blatta surinamensis*, L., De Geer, op. cit. p. 539, pl. 44, f. 8.
   = *Pycnoscelus surinamensis*, L. Type.

One example with the abdomen missing.

From Surinam.

9. *Blatta grisea*, De Geer, op. cit. p. 540, pl. 44, f. 9.
   = *Epilampra grisea*, De Geer.
   (*syn. Blatta maculicollis*, Serv.
   ? *Phyllodromia burmeisteri*, Guér.
   Epilampra brasiliensis, Brunner (*nec* Fab.) .)
   1 ♂ with label in Stål's handwriting, "*Epilampra burmeisteri*, Sauss."

Description of the type :—

♂. Testaceous. Head with sparse castaneous mottlings on the vertex and frons. Eyes converging slightly on frons which is slightly depressed and faintly wrinkled between lower part of eyes; least distance between eyes greater than breadth of 1st antennal joint but less than its length. Pronotum sprinkled with minute castaneous points, but almost devoid of the lyrate markings characteristic of the genus, these being represented by two triangular castaneous points near base of the disc. Tegmina testaceous, a few scattered castaneous dots along the radial vein and at apex, mediastinal vein with 2 short branches, 11 costals, radial bifurcate, 10 longitudinal discoidal sectors. Abdomen beneath sprinkled with castaneous; supra-anal lamina produced, bilobed, exceeding in length the subgenital lamina which is rather narrow, slightly asymmetrical and furnished with 2 slender styles. Cerci rather long. Legs testaceous, front femora with 5 spines on anterior margin, 3 on posterior margin beneath, mid-femora with 4 on both margins, hind-femora 3 on anterior margin, 4 on posterior margin; formula of apical spines $\frac{2}{1}$, $\frac{1}{1}$, $\frac{1}{0}$, no genicular spines on front femora. Posterior metatarsus longer than remaining joints; all the tarsal joints biseriately spined beneath.

Total length 24·1 mm.; body-length 20·4 mm.; tegmina 20·5 mm.; pronotum 5 mm. × 6 mm.

Recorded from Surinam.

10. *Blatta nivea*, L., De Geer, op. cit. p. 540, pl. 44, f. 10.
= *Panchlora nivea*, L. Type.
(*syn. Panchlora virescens*, Thunb.)
1 ♂.

The genus *Panchlora* includes several species described by the older authors, e. g. *viridis* Fab., *hyalina* Stoll, *virescens* Thunb., *exoleta* Burm., *viridis* Burm., *chlorotica*, Pall.; to determine these with accuracy or to fix their synonymy is a matter of impossibility unless all the types are critically examined. De Saussure and Zehntner in the "Biologia Centrali-Americana. Orthoptera," vol. i, p. 90–92, have drawn up a synoptical key to the species of *Panchlora* without consulting any of the older types; such a key certainly enables the student to give a name to his specimens, but by no means does it follow that these names are correct, in fact it must be a matter of pure chance if the use of such a key enables the systematist to identify any one of his specimens with accuracy. A good example of this is shown in the species under notice, *P. nivea*, L.; the key of de Saussure and Zehntner accidentally is correct in diagnosing *P. virescens* Thunb., but *P. nivea*, L. is situated in another part of the key; yet these two species are the same, as I have discovered from an examination of De Geer's specimen which I accept as the Linnean type and of Thunberg's type. The identification of the species of *Panchlora* is most difficult, as they resemble each other very closely and present scarcely any characters that do not vary to such an extent that they are practically useless for purposes of discrimination. One character however appears to be of some importance, viz. the form of the cerci, and the size of their apical joints when viewed from below. In a species which I identify provisionally as *P. antillarum* Sauss., the cerci are broad, somewhat spatulate and with the last two joints much enlarged; in *P. viridis* Fab., the cerci are lanceolate with the last two joints enlarged; in *P. nivea*, L., the cerci are lanceolate with the last joint only enlarged. This character occurs in both sexes, and taken in conjunction with

the general size of the insect and the distance apart of the eyes is of considerable help in discriminating the species. In *P. nivea*, L., the eyes almost touch on the vertex of the head, and the male type has the following dimensions:—Total length 16 mm.; length of body 12 mm.; length of tegmina 13·5 mm.; pronotum 3·9 mm. × 4·1 mm. The antennæ are unicolorous, and the tegmina are immaculate. This is the commonest species of the genus, and will eventually be proved, I am sure, to have been described over and over again; it frequently finds its way to England, lurking in imported fruit, and has been recorded in the lists of Natural History societies as *P. exoleta* Burm, and as *P. virescens* Thunb. The type is recorded from Surinam.

11. *Blatta oblongata*, L., De Geer, op. cit. p. 541, pl. 44, f. 11.

= *Pseudomops oblongata*, L.

The specimen in De Geer's cabinet is much mutilated, consisting of the head and the two thoracic segments only; the tegmina also are missing. The head is piceous, with first and basal half of second joint of maxillary palpi flavo-testaceous, the rest of the palpi fuscous. Pronotum flavo-testaceous with a complex fusco-castaneous design on the disc. As already pointed out, this does not correspond with Linnæus' description "thorace punctis duobus lunulaque nigris" nor with De Geer's figure and description. The species is most nearly allied to *Pseudomops angusta*, Wlk.

12. *Blatta minutissima*, De Geer, op. cit. p. 542, pl. 44, ff. 13, 14.

= *Holocompsa minutissima*, De Geer.

(? *syn. Holocompsa cyanea*, Burm.)

One specimen in bad condition, the abdomen missing.

Description of the type:—

Head fuscous with a sparse rufous pubescence, clypeus and labrum testaceous; antennæ (mutilated) fuscous. Pronotum fuscous with a recumbent rufous pubescence. Tegmina with basal half coriaceous, castaneous, apical half membranous, hyaline, marginal area with rufous pubescence 6 to 7 costal veins anal vein impressed and bent

at a right angle. Wings not longer than tegmina; marginal area with a castaneous "stigma" formed by the incrassated branches of the mediastinal vein and by the five incrassated costal veins, the internervular spaces also being castaneous. Coxæ castaneous.

Total length 5 mm.; length of tegmina 4 mm.

From Surinam.

Brunner was the first to suggest that this species should be placed in the genus *Anaplecta*, and every other author has followed this lead without question. De Geer's figures are certainly too small and ill-defined to enable one to guess correctly at the systematic position of the species.

iii. Species described by Thunberg.

The papers in which Thunberg described new species of cockroaches are:—

1. Dissertatio Entomologica novas Insectorum species sistens. Part iv, pp. 76–78, Uppsala, 1784.
2. Några nya species af Blattae—slägtet beskrifna. Vetensk. Acad. nya Handl. vol. 31, pp. 185–189, pl. 5, 1810.
3. Blattarum novæ species descriptæ. Mém. Acad. St. Pétersb., vol. 10, pp. 275–293, pl. 14, 1826.

The second of these two papers containing the descriptions of seven new species has entirely escaped the notice of every subsequent authority on the *Blattidæ;* this neglect is rather remarkable, seeing that the paper was published in a well-known scientific journal, was furnished with a plate, and was referred to by Thunberg in a later memoir which is well-known to every orthopterist, viz., * Hemipterorum maxillosorum genera illustrata. Mém. Acad. St. Pétersb., vol. 5, pp. 211–301, pl. 3, 1815. It affords me considerable satisfaction to bring about the resurrection of this forgotten memoir, especially as this involves no startling changes in nomenclature. In his Dissertatio Entomologica de Hemipteris maxillosis Capensibus, Uppsala pp. 1–8, 1822, Thunberg enumerates four species of Blatta, but all of these have been described previously, either by himself or by Fabricius, and as the

* A manuscript copy of this memoir from the library of Audouin is in the Hope Library, Oxford Museum.

descriptions add nothing to those already published this paper will not be quoted below.

The Thunbergian collection of insects, which in its day must have been one of the largest in Europe, is still at Uppsala and is very much as Thunberg left it. Stål overhauled the Orthoptera, and though he published nothing concerning Thunberg's Blattidæ, nevertheless attached to most of the specimens the names of more recent authors. It is quite evident from a study of the collection that Thunberg was by no means a "splitter," even if judged by the standard of scientific accuracy of his day, and as a result it is frequently the case that more than one species in his collection stands under the same specific name. To take one example:—under the name *Blatta grossa* stand three species of the genus *Monachoda*, and the question arises, which of these is to be selected as the type? Thunberg's description affords no help. The simplest course is to regard that specimen as the type which most closely approximates to the description of the species drawn up by later authors from specimens which they imagined to be identical with Thunberg's specimen. A certain definite species of *Monachoda* stands in all collections under the name *M. grossa* Thunb., it is recognised presumably not by Thunberg's description but by Serville's, Brunner's or that of some other authority; since in Thunberg's own collection there is an example of this species, that example, in the absence of all evidence to prove the contrary, may be selected as the type of his species *M. grossa*. The following is a list of the species described by Thunberg, taken in the order of their publication.

In the first column the Thunbergian name is given, in the second the correct name of the species, and in the third column some synonyms:—

	THUNBERG'S NAME.	CORRECT NAME.	SYNONYMS.
(1784)	1. *Blatta capensis* (op. cit. p. 77)	*Deropeltis erythrocephala*, Fab.	Cf. Kirby's Syn. Cat. Orth. i, p. 145.
	2. *Blatta fusca* (op. cit. p. 77)	*Aptera fusca*, Thunb.	*Aptera cingulata*, Burm.
	3. *Blatta deusta* (op. cit. p. 77 *)	*Oxyhaloa deusta*, Thunb.	Cf. Kirby, t. c. pp. 175, 176.
(1810)	4. *Blatta ferruginea* (op. cit. p. 187)	*Blatta orientalis* L., rufous var.	
	5. *Blatta bicolor* (op. cit. p. 187, pl. 5, f. A	*Pseudoderopeltis bicolor*, Thunb.	*Periplaneta orba*, Stål, *Ischnoptera juncea*, Sauss., *Nauphœta foveolata*, Wlk.
	6. *Blatta tuberculata* (op. cit. p. 187)	*Rhyparobia maderæ*, Fab. Larva.	
	7. *Blatta guttata* (op. cit. p. 188)	,, ,, ,, ,,	
	8. *Blatta scabra* (op. cit. p. 188)	*Hyposphæria scabra*, Thunb.	*Perisphæria unicolor*, Brunner (nec Burmeister). *Zetobora rugosa*, Wlk.
	9. *Blatta hirta* (op. cit. p. 189)	*Blepharodera hirta*, Thunb.	*Panchlora pilipes*, Wlk. †
	10. *Blatta ciliata* (op. cit. p. 189, pl. 5, f. B)	*Euthyrrhapha pacifica*, Coq.	
(1826)	11. *Blatta papillosa* (op. cit. p. 276, pl. 14)	*Monastria papillosa*, Thunb.	*Monastria semialata*, Sauss. *Monachoda granosa*, Brunn. *Blatta cassidea*, Dalm., may be the same species, if it is, that name antedates Thunberg's, but the type is missing.
	12. *Blatta pellucens* (op. cit. p. 276, pl. 14)	*Cyrtilia pellucens*, Thunb.	*Phoraspis luctuosa*, Sauss.
	13. *Blatta sexnotata* (op. cit. p. 276, pl. 14)	*Brachycola tuberculata*, Dalm.	Cf. Kirby, t. c. p. 196.
	14. *Blatta asellus* (op. cit. p. 277, pl. 14)	*Blabera asellus*, Thunb. Young larva.	
	15. *Blatta cinerea* ‡ (op. cit. p. 277)	*Epilampra grisea*, De Geer.	
	16. *Blatta limbata* (op. cit. p. 278)	*Nyctibora limbata*, Thunb.	*Nyctibora sericea*, Burm.
	17. *Blatta brunnea* (op. cit. p. 278)	*Nyctibora brunnea*, Thunb.	*Nyctibora holosericea*, Burm.
	18. *Blatta reflexa* (op. cit. p. 278)	*Petasodes reflexa*, Thunb.	Cf. Kirby, t. c. p. 161.
	19. *Blatta virescens* (op. cit. p. 278)	*Panchlora nivea*, L. ♀	
	20. *Blatta bipustulata* (op. cit. p. 279)	*Parahormetica bipustulata*, Thunb.	
	21. *Blatta convexa* (op. cit. p. 279)	*Cyrtilia convexa*, Thunb.	*Phoraspis heydeniana*, Sauss.
	22. *Blatta cylindrica* (op. cit. p. 279)	*Periplaneta cylindrica*, Thunb. var. Larva.	
	23. *Blatta gibba* (op. cit. p. 279)	*Notolampra gibba*, Thunb.	*Phoraspis cassidea*, Burm.
	24. *Blatta grossa* (op. cit. p. 280)	*Monachoda grossa*, Thunb.	

* *Blatta irrorata*, Fab., described in the same memoir is certainly not the same as the Fabrician species; it is represented in Thunberg's collection by two or three different species of *Epilampra*.

† *B. pilifera*, Stål, is a different species.

‡ It is not clear why Thunberg gave a new name to this species, which he recognised as identical with De Geer's species.

I append a description of *Parahormetica bipustulata*, as it is the only Thunbergian species which has not been redescribed by subsequent authors, and which in consequence cannot be recognised without a more detailed description than the original one.

♀ Dark castaneous. Pronotum almost smooth, no impressions, only a very few punctuations, a pair of small orange spots in the posterior half of the disc, widely separated. Tegmina lobiform, of the same shape as in *P. bilobata*, Sauss., extending to apex of second abdominal tergite. Supra-anal lamina rounded, surpassed by subgenital lamina into which it fits. Cerci blunt, short. Abdomen below with disc rufous. Legs rufous. Total length 29 mm.; length of tegmina 9 mm.; pronotum 9·5 mm. × 13 mm.

IX. Synonymical Notes.

The following Fabrician species have been omitted by Kirby from his Syn. Cat. Orthopt. vol. 1:—

Blatta occidentalis, Fabricius, Ent. Syst. ii, p. 7 (1793) to genus *Nauphœta*. *Rhyparobia rufipes*, Kirby is synonymous. Type in Copenhagen Museum. Fabricius gives the locality as "in Americæ insulis," and on the label borne by the type is written "St. Thomas Is." The species is characteristic of W. Africa, and it is possible that Fabricius confused the Island of San Thomé with the West Indian island.

Blatta palliata, Fabricius, Ent. Syst. Suppl. p. 186 (1798) to genus *Hemithyrsocera*. *H. nigra*, Brunner is synonymous. Type in Copenhagen Museum.

Blatta reticulata, Fabricius, op. cit. p. 186 to genus *Phyllodromia*. Type in Copenhagen Museum.

Blatta ruficollis, Fabricius, Mant. Ins. i, p. 226 (1787) to genus *Ischnoptera*. Type in Copenhagen Museum.

I was unable to find the type of *Blatta longipalpa*, Fab.

The following notes result from an examination of Stål's types:—

Blatta pumila, Stål, is a species of *Anaplecta* probably conspecific with *A. lateralis*, Burm.

Blatta misella to genus *Hololampra*.

Blatta tenella is a synonym of *Euthyrrhapha pacifica*, Coq.
Thyrsocera (= *Pseudothyrsocera*) *circumclusa*, Stål, is ♀ of *P. circumcincta* Stål, and *P. semicincta* is ♀ of *P. rufiventris*, Stål.
Epilampra tagalica, *E. trivialis* and *E. caliginosa* are conspecific.
Cutilia tartarea is a synomym of *Platyzosteria nitida*, Brunner.
Periplaneta wahlbergi to genus *Deropeltis; D. atra*, Brunner, is a synonym.
Periplaneta albilatera to genus *Pseudoderopeltis.*
Pollusca and *Homalodemas* are synonyms of *Derocalymma*, Burm.
Blabera monstrosa is a synonym of *Monastria biguttata*, Thunb.
Blabera luctuosa is not synonymous with *B. atropos*, Stoll.

The following corrections should be made in the list of Blattidæ from the Transvaal given in Mr. Distant's "Insecta Transvaaliensia."

Phyllodromia delta, Kirby, is synonymous with *P. supellectilium*, Serv.
Apotrogia, Kirby, is founded on a larva of the genus *Gyna*, and *A. angolensis*, Kirby, is probably the same as *Gyna caffrorum* Stål.
Deropeltis distanti, Kirby, is synonymous with *Blatta meridionalis*, Sauss.
Nauphæta aspersata, Kirby, is a species of *Oxyhaloa* possibly conspecific with *O. ferreti*, Reiche.
Elliptoblatta uniformis, Kirby, is a species of *Hyposphæria.**
Pilema saussurei, Kirby, described as a female, is in reality an immature male and probably the same as *P. clypeata*, Sauss.
Derocalymma intermedia, Kirby, is a synonym of *D. versicolor*, Burm.
Derocalymma clavigera, Kirby, is a species of *Hostilia.*

Dr. G. W. Müller of the Greifswald Museum having kindly lent me some of Gerstäcker's types, I am able to make the following corrections in nomenclature :—

* I do not think that *Melanosilpha*, Stål, is distinct from *Hyposphæria*, Lucas.

Phyllodromia	*patricia*	to be transferred	to	*Theganopteryx.*
„	*pulchella*	„	„	*Theganopteryx.*
„	*cinnamomea*	„	„	*Ischnoptera.*
„	*basalis*	„	„	*Ischnoptera.*
„	*punctifrons*	„	„	*Ischnoptera.*
„	*ægrota*	„	„	*Ischnoptera.*
„	*relucens*	„	„	*Ischnoptera.*

hemerobina, centralis, pustulosa, and *obsoleta* are true species of *Phyllodromia;* the type of *P. amplicollis* is lost.

Panchlora adusta and *P. vitellina* are true species of *Panchlora.*

From the Annals and Magazine of Natural History,
Ser. 7, Vol. xix., *January* 1907.

On some new Species of Blattidæ *in the Oxford and Paris Museums.* By R. Shelford, M.A., F.L.S.

Subfam. *Ectobinæ.*

Genus Anaplectoidea, Shelf.

Anaplectoidea Dohertyi, sp. n.

♀. Clear testaceous, nitid. Head rufo-testaceous, antennæ testaceous. Pronotum posteriorly truncated, exposing the scutellum, testaceous, lateral margins hyaline. Tegmina with fifteen costal veins; anterior ulnar with six branches, some of which are oblique, posterior ulnar simple; anal vein strongly curved, well marked; four axillary veins; the part of the right tegmen overlapped by the left reticulated. Wings hyaline, suffused with a pale flavid tint, with ten costal veins incrassated at the apex; medio-discal field crossed by eleven transverse veinlets; ulnar vein curved upwards, with five branches, the medio-ulnar field only one third the breadth of the medio-discal field, first anal vein quadriramose; apical area small, barely one fifth of total wing-length, its basal margin obtusely angled, its apex slightly emarginate, divided almost equally by a longitudinal vein. Supra-anal lamina produced, its apical margin straight; subgenital lamina ample, semiorbicular; cerci elongate, nine-jointed.

Length of body 7 mm.; length of tegmina 6 mm.

Sangir (*W. Doherty*); one example (Oxford Mus.).

Genus Hololampra, Sauss.

Hololampra minuta, sp. n.

♀. Head rufo-castaneous, antennæ fuscous with exception of first two basal joints, which are testaceous. Pronotum covering vertex of head, trapezoidal, the angles rounded, sides deflexed, posterior margin nearly straight; all the margins testaceous, most broadly at posterior angles; disk rufo-castaneous, with a posterior transverse castaneous vitta which is notched anteriorly. Tegmina ovate, smooth, shining, hyaline-testaceous, extending as far as middle of fourth abdominal tergite, the veins testaceous; eight costal veins, the last three ramose, discoidal sectors oblique and few in number, anal vein not impressed. Wings scale-like. Abdomen testaceous above, banded with black, beneath black margined with

testaceous, last segment and subgenital lamina rufo-castaneous; supra-anal lamina short, trigonal, with a median impressed line; subgenital lamina ample, semiorbicular, projecting beyond the supra-anal lamina; cerci moderate, black. Legs rufo-testaceous; femora very sparsely armed, not more than two spines on the anterior and posterior margins of each.

Total length 6 mm.; length of tegmina 4 mm.

Andrahomana, South Madagascar (*Ch. Alluaud,* 1901); two examples (Paris Museum).

One of the smallest species of the genus.

Subfam. *Phyllodrominæ.*

Genus Ischnoptera, Burm.

Ischnoptera Ridleyi, sp. n.

♂. Head ferruginous, a V-shaped darker mark between the antennal sockets; antennæ ferruginous, longer than the body. Pronotum rounded, posteriorly truncate, sides slightly deflexed, not covering vertex of head; disk rufous, with two broad vittæ, black in colour, not reaching the posterior margin, their outer margins sinuate, their inner margins straight. Tegmina ferruginous; radial vein bifurcated at the middle; sixteen costal veins; discoidal area with eleven longitudinal sectors; seven axillary veins. Wings hyaline, veins fuscous, the marginal field suffused with flavid; radial vein bifurcated at the middle, mediastinal vein with five branches; fourteen costal veins; median vein sinuate; ulnar vein with fourteen branches, six of which go to the apex of the wing. Abdomen infuscated above, ferruginous below; the seventh tergite notched in the middle of its posterior margin, the eighth very narrow; the eighth sternite reduced to a pair of lateral lappets; the supra-anal lamina quadrate, its posterior margin notched and produced on each side of the notch into two curved and slender processes; the subgenital lamina subquadrate, its posterior margin much thickened, forming two asymmetrical swellings which are grooved and furnished with numerous minute denticles; styles absent. Front femora with the anterior border beneath armed throughout its length with long stout spines.

Length of body 22 mm.; length of tegmina 20 mm.

Singapore (*H. N. Ridley,* March to May, 1906); one example (Oxford Museum).

This species, like so many of its Oriental congeners, presents unusual modifications of those external parts which are

related to reproduction. The form of the subgenital lamina in *I. Ridleyi* recalls that of *Hemithyrsocera histrio*, Burm.

Ischnoptera perpulchra, sp. n.

♀. Head testaceous, antennæ (mutilated) testaceous at base. Pronotum trapezoidal, posterior margin slightly produced; disk flavo-testaceous, encircled by a broad penannular ring of black, open on the anterior margin, lateral and posterior margins testaceous. Tegmina castaneous, margin testaceous; eighteen costal veins; radial vein bifurcated beyond the middle, the lower branch sending ramifications to the apex of the wing; discoidal field with nine longitudinal sectors, the most internal of which are angled. Wings hyaline, veins fuscous, marginal field bordered with testaceous; mediastinal vein with six branches, ten to twelve costal veins, radial vein bifurcated beyond the middle; ulnar vein with seven branches, three of which run towards the dividing vein. Abdomen flavo-testaceous above, except at the apex, which is fuscous, testaceous below; supra-anal lamina produced triangular, subgenital lamina ample. Legs testaceous; front femora armed on the anterior margin beneath with strong spines throughout its length, the most basal the longest; formula of apical spines $\frac{3}{1}, \frac{1}{1}, \frac{1}{1}$; front femora without a genicular spine, unless the most anterior apical spine is to be regarded as such.

Length of body 12 mm.; length of tegmina 14 mm.

Macassar, Celebes (*W. Doherty*, 1896); one example (Oxford Museum).

This species is rather a puzzling one; the angulation of some of the discoidal sectors of the tegmina suggests the genera *Pseudomops* and *Pseudothyrsocera*, but this is a character that also crops up in *Phyllodromia*, and, taken by itself, is not of the greatest importance; it is on account of the branching of the vena ulnaris alarum, so characteristic of *Ischnoptera*, that I have referred this species to that generic position.

Ischnoptera cavernicola, sp. n.

♂. Head castaneous, mouth-parts testaceous; antennæ testaceous, one and a half times longer than the body. Pronotum rufo-castaneous, with lateral and posterior margins narrowly castaneous. Tegmina clear testaceous, radial vein bifurcated, twelve costal veins, six discoidal sectors. Wings hyaline, mediastinal vein with three branches, seven costal

veins, radial vein not bifurcated, ulnar vein sending three branches to the dividing vein and three to the apex of the wing. Abdomen rufo-testaceous, supra-anal lamina slightly produced, rounded; subgenital lamina produced, narrow, with two stout styles; cerci elongate. Legs rufo-testaceous; front femora with anterior margin beneath armed throughout its length with a series of short spines, the most distal the shortest; apical spines $\frac{1}{1}$, $\frac{1}{1}$, $\frac{1}{1}$; genicular spines 1, 1, 1.

Length of body 10 mm.; length of tegmina 9·5 mm.

In cave at Bidi, Sarawak, Borneo (*R. Shelford*); one example (Oxford Museum). [No. 22.]

The species, which can be readily recognized by the pale pronotum with dark margins, was found in some numbers in a large and quite dark cave in the limestone formation at Bidi, Sarawak; it is somewhat remarkable that this cockroach, a Stenopelmatid (? *Dolichopoda*), and a species of crab (*Potamon bidiense*, Lanch.), which were all found in considerable numbers in the darkest part of the cave, show no reduction in size of the eyes; one can only suppose that the caves have been peopled within quite recent times by these Arthropoda. The antennæ of the Stenopelmatid are of great length, but this is not the case in *Ischnoptera cavernicola*.

Genus Ellipsidium, Sauss.

Ellipsidium castaneum, sp. n.

♀. Head dark rufous, with a black spot between the antennal sockets; antennæ with the basal half strongly incrassated, black, the two basal joints rufous, apical half with a testaceous band occupying ten lower joints, the remaining joints fuscous. Disk of the pronotum rufo-testaceous, with a symmetrical black design, anterior and posterior margins pale testaceous, lateral margins hyaline. Tegmina castaneous, with the densely reticulated veins pale testaceous, the mediastinal field hyaline. Wings infuscated, veins flavid. Abdomen black beneath, sternites with white margins; subgenital lamina with the apex slightly cleft; cerci black, with castaneous legs. Legs castaneous, the coxæ black, with white borders, the tarsi black.

Total length 14 mm.; length of tegmina 12·5 mm.; pronotum 4 × 6 mm.

Humboldt Bay, New Guinea (*W. Doherty*, 1896); one example (Oxford Museum).

This well-marked species somewhat extends the range of the genus, hitherto known only from Australia.

Genus Piroblatta, nov.

Differs from *Chrastoblatta*, Sauss. & Zehnt., by the less prominent vertex, by the shape of the pronotum, by the greater breadth of the tegmina, and by the presence of a prominent triangular apical area in the wings.

Head almost covered by the pronotum; pronotum trapezoidal, anterior margin truncate, sides deflexed, posterior margin slightly arcuate; scutellum exposed; tegmina longer than the body, discoidal sectors oblique. Wings with a large apical triangle, projecting beyond the anterior part of the wing; ulnar vein bifurcate and sending also two to three branches to the dividing vein. Front femora unarmed beneath, mid and hind femora very sparsely armed on both borders beneath; genicular spines present on all the femora. Supra-anal lamina in the male somewhat quadrately produced, in the female triangularly produced.

On a re-examination of the species described by me as *Theganopteryx Bouvieri* (Trans. Ent. Soc. 1906, p. 236) I have come to the conclusion that a new genus must be established for this and for the species described below. In general appearance both species are very like *Theganopteryx*, but the branching of the ulnar vein of the wings is sufficient to place them close to the genus *Chrastoblatta*, from which, however, they may be distinguished by the points enumerated above. Both species are testaceous in colour and quite unlike the conspicuous *Chrastoblatta dimidiata*, Sauss. & Zehnt., and *C. tricolor*, Sauss. & Zehnt. The females are shorter and a little broader than the males.

Piroblatta Alluaudi, sp. n.

♂. Head rufo-castaneous; maxillary palpi and antennæ testaceous, the latter longer than the body; pronotum rufo-testaceous, the lateral margins hyaline. Tegmina testaceous hyaline; fifteen to sixteen costal veins, eight oblique discoidal sectors. Wings hyaline; veins fuscous, marginal field flavid; fourteen to fifteen costal veins, their apices very slightly incrassated; ulnar vein bifurcated and sending three branches to the dividing vein; first axillary vein quadriramose, triangular apical field large. Legs and cerci rufo-testaceous. Abdomen piceous; supra-anal lamina trigonal, subgenital lamina semiorbicular; the left style stout and curved, the right style minute.

♀. Similar to the male, but shorter; supra-anal lamina triangular; subgenital lamina ample.

♂. Length of body 7 mm.; length of tegmina 8 mm.

♀. Length of body 7 mm.; length of tegmina 7·5 mm.

Diego Suarez, Madagascar (*Alluaud*, April 1896); eight examples (Paris Museum).

Piroblatta Bouvieri, Shelf.

Theganopteryx Bouvieri, Shelford, Trans. Ent. Soc. London, 1906, p. 236.

The female has the pronotum less strongly marked with testaceous than the male; the supra-anal lamina is trigonal, the subgenital lamina ample and semiorbicular; the tegmina measure 8 mm., as against 10·8 mm. in the male, the body 8 mm., as against 9·5 mm. in the male.

Genus Phyllodromia, Serv.

Phyllodromia picturata, sp. n.

♂. Head testaceous, with castaneous markings, forming a symmetrical design. Pronotum transversely elliptical, lateral margins hyaline; disk of the pronotum pale testaceous, with castaneous markings composed of irregular spots and two central longitudinal lines; a few minute castaneous points in the hyaline margins. Tegmina hyaline testaceous, with castaneous spots disposed along the veins, denser at two points in the marginal field, forming two indistinct maculæ; an oblique castaneous fascia on the right tegmen extending from the middle of the anal field to the apical third of the radial vein; mediastinal vein with two branches, radial vein not bifurcated, twelve costal veins; anterior ulnar vein sending several branches to the sutural margin, posterior ulnar vein simple; anal vein somewhat sinuate, its apex suddenly bent inwards. Wings hyaline; nine costal veins, the six basal clavately incrassated, the apical three ramose; ulnar vein with five branches. Abdomen infuscated above, testaceous, marbled with fuscous below; supra-anal lamina short, transverse; subgenital lamina ample, somewhat irregular, the left style larger than the right and curved (cerci mutilated). Legs testaceous; tibiæ banded with castaneous; tarsi fuscous except the basal two thirds of the first joint; front femora not armed beneath; mid and hind femora sparsely spined; apical spines $\frac{1}{0}$, $\frac{1}{1}$, $\frac{1}{1}$; no genicular spine on front femora.

Length of body 9 mm.; length of tegmina 10 mm.; pronotum 2·2 × 4·5 mm.

Singapore, Botanic Gardens (*H. N. Ridley*); one example (Oxford Museum).

The species in the characters presented by the femora and supra-anal lamina resembles the Ectobinæ, but the wing-structure is typically Phyllodromine.

Phyllodromia albovariegata, sp. n.

♀. Head dark castaneous, with two diverging testaceous lines running from the vertex to the sides of the clypeus; clypeus rufo-testaceous; palpi fusco-testaceous; antennæ testaceous at base, the rest fuscous. Pronotum trapezoidal, dark castaneous, with a narrow central line testaceous, lateral margins hyaline. Tegmina dark castaneous, paler towards the apex, mediastinal field and base of marginal field hyaline; a transverse white fascia extending from the marginal field to the apex of the anal field, not meeting its fellow of the opposite side; twelve costal veins, the apical four branched, discoidal sectors oblique. Wings infuscated, costal margin very narrowly flavid; eleven costal veins, their apices incrassated; ulnar vein 5-ramose, the branches joined by transverse venulæ; a prominent apical triangle. Abdomen fuscous, with a fulvous patch on the disk below; supra-anal lamina short, transverse; subgenital lamina large, produced, its apex cleft; cerci long, testaceous. Legs testaceous, front femora armed with several spines on the anterior margin beneath, the more distal being the shortest of the series; mid femora strongly spined; hind femora sparsely spined, apical spines $\frac{2}{1}$, $\frac{1}{1}$, $\frac{1}{1}$; no genicular spine on front femora.

Length of body 6·2 mm.; length of tegmina 7 mm.

Fernando Po (*L. Conradt*, 1901); one example (Paris Museum).

Phyllodromia nimbata, sp. n.

♂. Testaceous. Head with a rufous band between the eyes and sometimes with a narrower band between the antennal sockets. Pronotum trapezoidal; lateral margins hyaline; disk testaceous, with rufous markings symmetrically disposed. Tegmina clear testaceous; ten costal veins, five longitudinal discoidal sectors. Wings hyaline; mediastinal vein with two branches; eight to nine costal veins, their apices clavately incrassated; ulnar vein with four branches. Abdomen infuscated above, testaceous below, with

fuscous margins; supra-anal lamina trigonal, slightly emarginate; subgenital lamina triangularly produced, with two styles; cerci elongate, testaceous. Legs testaceous; front femora armed on anterior margin beneath with a series of spines, the most distal short and serried; apical spines $\frac{1}{1}, \frac{1}{1}, \frac{1}{1}$; all the femora with genicular spines.

♀. Head entirely rufo-testaceous; supra-anal lamina transverse; subgenital lamina ample, semiorbicular, posterior margin slightly but widely emarginate.

	♂.	♀.
Length of body	11 mm.	8·1 mm.
Length of tegmina	10 mm.	9·8 mm.

Kuching, Sarawak, Borneo; five examples (Oxford Museum). [No. 29.]

The species is undoubtedly closely allied to *Phyllodromia liturifera*, Stål, the type of which is now before me, but differs in the following points:—It is smaller; the head is not marked with three castaneous bands; the coloration of the tegmina is different; the wings are clear hyaline and their veins pale testaceous; the costal veins are more numerous; the supra-anal lamina is slightly more produced and its apex is emarginate; the subgenital lamina is narrower. It is quite evident that de Saussure correctly identified *P. liturifera*, Stål (Mél. Orthopt. ii. p. 56, 1869), and his detailed description of the species is perfectly accurate in every point.

Phyllodromia nebulosa, sp. n.

♂. Head testaceous; four longitudinal lines on the vertex, three indistinct transverse bands on the face, castaneous. Pronotum trapezoidal, lateral margins hyaline, disk marbled with castaneous and testaceous. Tegmina clear testaceous, with numerous irregular castaneous markings occurring between the veins; ten to eleven costal veins, five longitudinal discoidal sectors. Wings hyaline; veins testaceous, mediastinal vein with two branches; eight costal veins, their apices clavately incrassated; ulnar vein with four branches. Abdomen infuscated; supra-anal lamina triangular; subgenital lamina ample, semiorbicular, with two styles, the margin of the lamina emarginate at their points of insertion; cerci long, testaceous, base and apex fuscous. Legs testaceous, the tibiæ banded with fuscous; armature of femora as in the preceding species.

♀. All the castaneous markings on the head more distinct;

supra-anal lamina transverse, slightly emarginate; subgenital lamina very large, its posterior margin slightly and asymmetrically emarginate.

	♂.	♀.
Total length	10 mm.	11 mm.
Length of tegmina	9 mm.	8 mm.

Kuching, Sarawak, Borneo; three examples (Oxford Museum). [No. 30.]

The small size of the species and the marbling of the tegmina with darker markings serve to distinguish it from any of the described Oriental forms; its nearest ally appears to be *P. ignobilis*, Wlk., from Sula Islands.

Phyllodromia Hewitti, sp. n.

♂. Fulvo-castaneous. Antennæ equal to total length of body, fuscous except at base. Pronotum trapezoidal, smooth, shining, sides deflexed, not covering vertex of head, with obscure darker markings, posterior margin slightly produced. Tegmina with radial vein bifurcated, twenty-one costal veins, discoidal area with nine longitudinal sectors. Wings with marginal area somewhat coriaceous; mediastinal vein with five branches, radial vein bifurcated from near base; twelve costals; ulnar vein with three branches; a prominent triangular apical area. Front femora with eleven long spines on anterior margin beneath, the more distal closely set together; formula of apical spines $\frac{2}{1}$, $\frac{1}{1}$, $\frac{1}{1}$; no genicular spine on front femora. Supra-anal lamina triangular; subgenital lamina produced, highly irregular in appearance; no styles.

Total length 21 mm.; length of body 18 mm.; length of tegmina 18 mm.

Kuching, Sarawak. [No. 27.]

This species, which I have pleasure in naming after Mr. J. Hewitt, Curator of the Sarawak Museum, has all the appearance of an *Ischnoptera*, but the wing-venation is that of a typical *Phyllodromia*; it is, perhaps, most nearly allied to *P. ferruginea*, Br.

Phyllodromia (?) *japonica*, sp. n.

♀. Rufo-castaneous, nitid, broad, short. Head with a darker mark between the eyes; antennæ longer than the body, fuscous except at base. Pronotum trapezoidal, sides deflexed, not quite covering vertex of head, posterior margin

very slightly angled; a short black line on each side in front. Tegmina not longer than abdomen; radial vein bifurcate; eleven costals; seven axillaries; discoidal sectors oblique. Wings suffused with rufo-testaceous; mediastinal vein with three branches, radial vein bifurcated; eight costals; ulnar vein with three rami reaching apex of wing and two irregular and anastomosing rami which are directed towards the apex of wing but do not reach it; no apical triangle. Abdomen dark castaneous above and beneath, margined with paler; supra-anal lamina triangular; cerci moderate; subgenital lamina ample. Legs rufo-testaceous, all the femora strongly armed; no genicular spine on front femora; formula of apical spines $\frac{2}{1}$, $\frac{1}{1}$, $\frac{1}{1}$.

Total length 15·2 mm.; length of tegmina 12 mm.; pronotum 5·5 × 7·9 mm.

Riou-Kiou, Oshima, Japan; three examples (Paris Museum).

This is a very puzzling species, and I include it in the genus *Phyllodromia* with considerable doubt; in general appearance it approaches the Madagascar species of *Allacta*, but it certainly does not belong to that genus. The wing-venation is suggestive of the genus *Ischnoptera*, but does not strictly conform to that type nor to the wing-venation of *Phyllodromia*.

Genus Pseudophyllodromia, Br.

Pseudophyllodromia elegans, Shelf.

♀. Head flavo-testaceous; a rufous band on the vertex and between the eyes; antennæ fuscous except three basal joints, which are testaceous; second and third joints of maxillary palpi black. Pronotum transversely elliptical, anteriorly truncate, posteriorly very slightly angulate; lateral margins broadly, posterior margin narrowly hyaline testaceous; disk dark castaneous, with four testaceous markings; an anterior median line, stopping short before the middle of the disk; two dots on each side of the middle line in the centre of the disk, a median posterior dot, in addition a rufescent marking on each side of the disk in front. Tegmina fusco-castaneous, marginal area and area between radial and anal vein testaceous hyaline; twelve to thirteen costal veins, five discoidal sectors, five axillary veins. Abdomen fusco-castaneous above; supra-anal lamina short, trigonal; abdomen beneath and legs flavo-testaceous; subgenital lamina ample, tipped with fuscous, its posterior margin cleft in the middle; cerci moderate, testaceous.

Total length 11·5 mm. ; length of body 9 mm. ; length of tegmina 9·2 mm.

Maroni, French Guiana (*F. Geay*, 1903) ; one example (Paris Museum).

P. histrio, Sauss., appears to be the nearest ally of this species, which is well marked by the dark tegmina with one hyaline band.

Genus Pseudectobia, Sauss.

Pseudectobia Alluaudi, sp. n.

♀. Rufo-testaceous. Antennæ and mouth-parts testaceous. Pronotum covering vertex of head, trapezoidal; anterior margin truncate, posterior margin obtusely angled, lateral margins pellucid, with an opaque testaceous submarginal band bordered inwardly by a rufous suffusion. Tegmina convex, nitid, venation of anal and discoidal fields obsolete; anal vein deeply impressed, arcuate, reaching sutural margin at a point on one half of its length; fifteen costals. Wings small, hyaline; radial vein bifurcated near its apex; twelve costal veins; ulnar vein triramose; apical triangle well defined, projecting beyond the anterior margin. Abdomen broad; supra-anal lamina triangular; subgenital lamina semiorbicular, projecting slightly beyond the supra-anal lamina. Front femora with eleven spines along the anterior margin beneath; hind femora with four pairs of spines; genicular spines and a pair of apical spines on each femur.

Total length 10 mm. ; length of tegmina 7 mm.; pronotum 3 × 5 mm.

Diego Suarez, Madagascar (*Alluaud*, April 1896) ; one example (Paris Museum).

De Saussure created this genus or subgenus for the reception of the species *Luneli*, Sauss., *liturifera*, Stål, *insularis*, Sauss., regarding the apical triangle and branched ulnar vein of the wings of prime importance. As I have shown (Trans. Ent. Soc. London, p. 231, 1906), the presence of an apical triangle in the wings is a feature that appears in so many subfamilies of Blattidæ, that, taken by itself, it is of small value for purposes of generic distinction. I do not believe that *liturifera*, Stål, and *insularis*, Sauss., are congeneric, and I have seen the types of both species; *Luneli*, Sauss., is congeneric with *liturifera*, Stål, and I do not see how either species can be separated from the genus *Phyllodromia*; *insularis*, Sauss., is a broad convex insect, very

different from the other two species, and may well be selected as the type of the genus, which can be distinguished by the following characters:—

Broad, convex insects; the tegmina not projecting much beyond the tip of the abdomen, their venation sometimes obsolete in the anal and discoidal fields. Wings with an apical triangle, the ulnar vein ramose. Femora generally strongly armed. Supra-anal lamina variable, but usually produced.

Type of the genus *P. insularis*, Sauss.

The other species of the genus are *P. bipunctata*, Wlk., *P. adimonialis*, Wlk. (=*Lupparia adimonialis*), possibly *P. latipennis*, Br. (=*Phyllodromia latipennis*), and the new species described above. Of the species previously included in the genus, *P. pallidula*, Bol., and *P. vœltzkowiana*, Sauss. & Zehnt., have the supra-anal lamina produced, the abdomen is missing in *P. Luneli*, Sauss., and in *P. intermedia*, Sauss. & Zehnt.; it is probable that the shape of this tergite is as variable as in the genus *Phyllodromia*, and too much reliance should not be placed on its transverse form in *P. subpectinata*, Sauss. & Zehnt., and *P. antiguensis*, Sauss. & Zehnt. In all these species the armature of the femora is most variable. They cannot be placed in the genus *Theganopteryx* on account of the ramose character of the *vena ulnaris alarum* (*cf.* Trans. Ent. Soc. p. 232, 1906), but the presence of a triangular apical area in the wings does not forbid their entry in the genus *Phyllodromia*, seeing that this character does occur in several well-marked and well-recognized species of that genus. *P. punctulata*, Sauss. & Zehnt., must be referred to the genus *Theganopteryx*.

Subfam. *Nyctiborinæ*.

Nyctibora bicolor, sp. n.

♀. Head entirely black, with a scanty erect pubescence on the front; ocelli minute, testaceous; antennæ incrassated, black, apical joints rufescent, densely pubescent. Pronotum transversely elliptical, anterior border not nearly covering vertex of head; posterior border more arcuate than anterior, covering the scutellum; disk with two converging impressions, flavo-testaceous, with a shield-shaped black mark on the disk, posterior margin with a fine black line. Tegmina coriaceous, serio-punctate and reticulate between the raised veins, not pubescent; the basal three fifths flavo-testaceous, the apical two fifths dark castaneous; radial vein black throughout its

length, sutural margins black, anal vein deeply impressed, mediastinal vein sending several branches to the margin, costals numerous. Wings dark castaneous, ulnar vein with nine branches. Abdomen entirely black, except apical half of subgenital lamina, which is flavo-testaceous; supra-anal lamina triangular, produced; subgenital lamina ample, its lateral margins shortly produced; cerci black (mutilated). Legs black; front femora unarmed, mid femora with four spines on posterior margin, none on anterior margin; hind femora with two spines on posterior margin, none on anterior margin; genicular spines on second and third femora; formula of apical spines $\frac{2}{1}, \frac{1}{1}, \frac{1}{0}$.

Total length 26·8 mm.; length of body 17 mm.; length of tegmina 23·8 mm.; pronotum 6 mm. × 8·5 mm.

Yarimaguas, Peru (*Sallé*, 1886); one example (Paris Museum).

This species, that described below, and *N. crassicornis*, Burm., should probably be included in a new genus, characterized by the incrassated antennæ, shape of the pronotum, and sparse armature of the femora.

Nyctibora nigrocincta, sp. n.

♂. Head entirely black; antennæ black, except apical joint, which is castaneous, incrassated, pubescent. Pronotum as in the preceding species, but with the lateral and posterior margins slightly reflected and with a very scanty recumbent pubescence, yellow, with a shield-shaped black mark on the disk. Tegmina long, coriaceous at base and reticulate, not pubescent; four branches to the mediastinal vein, costals numerous; colour yellow, radial vein at base, a broad streak on sutural margin of anal field, a broad band from near the costal margin to the sutural margin in the apical third, black; apex castaneous. Wings fusco-castaneous; a broad pre-apical yellow band; costals irregular, six branches to the ulnar vein. Abdomen black above and below; supra-anal lamina triangular; subgenital lamina produced, very convex, with two styles; cerci black. Legs black; front femora with no spines beneath; mid femora with three to four spines on posterior margin, none on anterior margin; hind femora with five spines on posterior margin, none on anterior margin; genicular spines on the mid and hind femora; formula of apical spines $\frac{0}{1}, \frac{1}{1}, \frac{1}{1}$.

♀. Similar to ♂, but rather larger, the black band extending right across the tegmina, castaneous apex of tegmina more extended, subgenital lamina as in *N. bicolor*, mihi.

♂. Total length 24 mm.; length of body 17·5 mm.; length of tegmina 20 mm.; pronotum 4·2 mm. × 6 mm.

♀. Total length 27 mm.; length of body 20·2 mm.; length of tegmina 21 mm.; pronotum 5 mm. × 8 mm.

Colombia; four examples (Oxford Museum).

Subfam. *Epilamprinæ.*

Genus Notolampra, Sauss.

Notolampra antillarum, sp. n.

♂. Castaneous. Head and antennæ testaceous, the former with a few scattered castaneous punctures. Pronotum not punctate, castaneous, the lateral borders broadly, the anterior margin narrowly, testaceous, semiopaque, with a few scattered fuscous or castaneous dots. Tegmina castaneous, the lateral borders testaceous, semiopaque with scattered castaneous dots, these borders are continuous with the pronotal testaceous borders and are broadest at the base, narrowing to the apex; radial vein marked at its base by a dark line, no other veins visible; surface of tegmina seriopunctate. Wings rufo-testaceous; intercalated apical triangle small. Abdomen rufo-testaceous; supra-anal lamina triangular, slightly notched; subgenital lamina trigonal, somewhat asymmetrical with two styles; cerci short. Legs testaceous spotted with castaneous; front femora with two spines only at base of anterior margin beneath, rest of anterior margin occupied by piliform setæ, one spine on posterior margin; mid and hind femora with two spines on anterior margin, four on posterior margin; formula of apical spines $\frac{2}{1}$, $\frac{1}{1}$, $\frac{1}{0}$; no genicular spine on front femora.

Total length 19 mm.; length of tegmina 14 mm.; pronotum 6 mm. × 7·5 mm.

Trinité, Martinique (*A. Bourgouin*, 1901); one example (Paris Museum).

The species is most closely allied to *Notolampra punctata*, Sauss., from Brazil, but differs in the testaceous borders of the tegmina and in its proportions.

Genus Apsidopis, Sauss.

Apsidopis Wallacei, sp. n.

♀. Pale testaceous. Frons concave and transversely striated; a chevron-shaped depression at base of clypeus and two marks between the eyes castaneous; antennæ fuscous

except basal joint; eyes $1\frac{1}{2}$ mm. apart. Pronotum cucullate, of the form characteristic of the genus, punctate and with numerous minute fuscous or castaneous maculæ. Tegmina semicoriaceous, densely serio-punctate between the veins in the basal two thirds, in the apical third the punctures merge into quadrangular interspaces between numerous reticulated interstitial veins, a few minute fuscous dots are scattered over the tegmina; mediastinal vein with ten branches; seven ramose costal veins; nine anal veins, the first ramose. Wings angulated at the apex as in the genus *Derocardia*, Sauss.; marginal area testaceous with fuscous spotting at apex, the apex semicoriaceous; mediastinal vein multiramose; costal veins irregular, the interspaces filled by reticulated interstitial veins; ulnar vein with nineteen branches. Supra-anal lamina ample, prominent, bilobed; subgenital lamina semiorbicular; cerci slender and short. Front femora with five spines on middle of anterior margin beneath, piliform setæ extending from them to apex, two spines on posterior margin; mid and hind femora with three to four spines on each lower margin; formula of apical spines $\frac{1}{1}$, $\frac{1}{1}$, $\frac{1}{0}$; minute genicular spines on mid and hind femora, none on front femora; posterior metatarsus shorter than remaining joints, its pulvillus produced proximally.

Length of body 30 mm.; length of tegmina 35 mm.; pronotum 11 mm. × 12·5 mm.

Sarawak (*Wallace*; Wilson Saunders collection, Oxford Museum).

The species is close to *A. oxyptera*, Wlk., also from Borneo, which exhibits the same characters of punctuation of the tegmina; but *A. oxyptera* is smaller, more rufous in colour, the proportions of the pronotum are different and the pronotum is less closely punctate, but more densely covered with castaneous dots. Both species can be distinguished from *A. acutipennis*, Sauss., by their larger size.

Subfam. *Blattinæ*.

Genus Blatta, L.

Blatta Rothschildi, sp. n.

♂. Rufo-castaneous. Head with four darker markings between the eyes; ocelli and clypeus testaceous; antennæ much longer than the body, first two joints and apical third rufo-castaneous, remainder fuscous. Pronotum trapezoidal; anterior and posterior borders truncate, flavo-testaceous, a

castaneous marking like an inverted **W** on the disk, a central testaceous line. Tegmina abbreviated, not extending much beyond the second abdominal tergite, surface reticulate, anal vein reaching internal posterior angle of tegmina. Wings rudimentary. The first and second abdominal tergites flavo-testaceous, third to fifth flavo-testaceous with castaneous lateral and posterior borders; sixth rufo-castaneous, enlarged; seventh flavo-testaceous with central castaneous macula, narrow, posterior margin sinuate and slightly emarginate in the middle; supra-anal lamina quadrate, broadly emarginate, rufo-castaneous with a testaceous macula at the postero-lateral angles. Cerci black, apices rufo-castaneous. Abdomen beneath rufo-castaneous, lateral margins castaneous and a castaneous stigma on second to fourth sternites; sub-genital lamina notched on each side, the long slender styles springing from the notches. Legs rufo-castaneous. Metatarsus scarcely equal to remaining joints, spined beneath, its pulvillus minute.

♀. Head black; ocelli, clypeus, genæ, vertex flavo-testaceous; antennæ rufo-castaneous. Pronotum as in ♂, but the discal black marking much enlarged, so that it occupies all the disk, leaving only a narrow sinuate flavo-testaceous margin, no central testaceous line. Tegmina squamiform, not extending beyond metanotum, black, with a yellow line at base; mesonotum, metanotum, and first five abdominal tergites black, with a broad central transverse flavo-testaceous band; sixth tergite enlarged, concavely depressed, black with flavo-testaceous lateral and posterior margins; seventh tergite somewhat triangularly produced, black, apex slightly emarginate, flavo-testaceous; supra-anal lamina produced, narrower than in ♂, broadly emarginate. Abdomen beneath and legs black, disk of abdomen rufo-castaneous; coxæ margined outwardly with flavo-testaceous, tibial spines and tarsi castaneous.

♂. Total length 21 mm.; length of tegmina 10 mm.; pronotum 5·8 mm. × 7·2 mm.

♀. Total length 26 mm.; length of tegmina 4 mm.; pronotum 8 mm. × 10 mm.

South of Lake Rudolph, Brit. E. Africa (*Maurice de Rothschild*, 1905); five examples (Paris Museum).

The nearest ally of the species appears to be *B. manca*, Gerst., from W. Africa.

Subfam. *Oxyhaloinæ.*

Genus Oxyhaloa, Br.

Oxyhaloa variabilis, sp. n.

♀. Rufo-castaneous. Vertex of head rufo-castaneous, a clear testaceous band between the antennæ, genæ testaceous; frons, clypeus, labrum, palpi, and antennæ shining black. Pronotum with two oblique impressions anteriorly, with a few minute punctures from which spring short slender hairs. Tegmina with the veins fuscous, sparsely pubescent, very variable in length, in some examples reaching tip of abdomen, in others lanceolate and extending no further than the third tergite; thirteen costals; discoidal field reticulate. Wings as variable in length as the tegmina, flavid at base, the rest infuscated; veins fuscous, ulnar vein with eight to nine rami, the basal ones transverse. Abdomen broad, black above, the margins of the segments narrowly rufous, beneath rufo-castaneous; supra-anal lamina short with rounded posterior angles, not emarginate; subgenital plate projecting beyond the supra-anal lamina, fuscous, ample, its margin sinuated; cerci short, fuscous, tipped with rufous. Legs black, apices of coxæ and femora rufous, tibial spines rufous.

Total length from 16 mm. to 13·5 mm.; length of body from 16 mm. to 12·5 mm.; length of tegmina from 11 mm. to 8 mm.; breadth of pronotum from 6·2 mm. to 5 mm.; length of pronotum from 4·5 to 4 mm.

Interior of Djibouti (*Hermann*); one example (Paris Museum).

This is the smallest species of the genus, and is remarkable on account of the variation in size of the wings and tegmina; apparently this variation bears no relation to the variation in size of the individual, for one of the smallest specimens has long tegmina and one of the largest has these organs much reduced.

Genus Paraplecta, nom. nov.

(= *Cirphis*, Stål.)

The name *Cirphis*, created by Stål in 1876 (Œfv. Vet.-Akad. Förh. xxxiii. p. 74) for a cockroach (*C. pallipes*) from Damara Land, is preoccupied, having been applied by Walker in 1865 to a genus of Noctuid moths.

Paraplecta æthiopica, sp. n.

♂. Castaneous, smooth, nitid; vertex of head not covered by pronotum; ocelli, apex of clypeus, mouth-parts, and antennæ testaceous; minutely punctured. Pronotum trapezoidal, with rounded posterior angles, minutely punctured; posterior margin truncate, exposing the scutellum. Tegmina semicoriaceous, barely reaching apex of abdomen; eleven or twelve costals; discoidal field reticulate, anal vein impressed; eight axillaries. Wings with a large apical reflected area, two fifths of total wing-length, its basal margin obtusely angled; costals highly irregular and obsolescent; median vein consisting of two parallel branches, with one or two transverse venulæ connecting them; ulnar vein with seven branches. Abdomen castaneous above, supra-anal lamina produced; abdomen rufo-castaneous below, subgenital lamina asymmetrical with one style (the left); cerci short, acuminate, 4-jointed. Legs testaceous; femora spineless, tarsal claws without arolia.

♀. Similar to ♂, but larger, tegmina and wings (when folded) not extending beyond the sixth abdominal tergite; supra-anal lamina produced quadrately; subgenital lamina ample, produced, narrowed posteriorly.

♂. Total length 9 mm.; length of tegmina 8 mm.; pronotum 3 mm. × 3·2 mm.

♀. Total length 11 mm.; length of tegmina 7 mm.; pronotum 3·5 mm. × 3·8 mm.

Fernando Po (*L. Conradt*, 1901); six examples (Paris Museum).

The species can readily be distinguished from *P. pallipes*, Stål, by the wing-structure: in Stål's species there is a conspicuous triangular apical area which in *P. æthiopica* has become extended to form an apical reflected area; the venation is very similar in both species, but in *pallipes* the costals are better marked and the rami of the ulnar vein are more numerous, the double median vein is common to both species.

Genus Choristima, Tepper.

Choristima, Tepper, Trans. Roy. Soc. S. Austral. xix. p. 165 (1895).
Aphlebidea, Brancsik, Jahresh. Ver. Trencsin. Com. xix. & xx. p. 56 (1897).

Kirby in his 'Synonymic Catalogue of Orthoptera' (1904), following Brancsik, places *Aphlebidea* in the Ectobinæ; but as the femora are unarmed beneath and a triangular apical field is present in the wings, the genus falls naturally into the

subfamily Oxyhaloinæ(=Plectopterinæ). *Aphlebidea* is undoubtedly the same as Tepper's genus *Choristima*, described two years previously, and *A. Brunneri*, Brancs., if not identical with *Choristima galerucoides*, Wlk., is most closely allied. *Blatta apicifera*, Wlk. (Cat. Blatt. B. M. p. 110, 1868), is the male of *C. galerucoides*, Wlk.: the type, which is in the British Museum, is in extremely poor condition, the abdomen and antennæ being missing; it is smaller than the female, the tegmina and wings are relatively longer and would, I imagine, extend beyond the tip of the abdomen. Tepper's diagnosis of the genus is extremely brief, but Brancsik's description of *Aphlebidea* is detailed enough to render it readily recognizable. The species included in the genus may be distinguished as follows:—

a. Subgenital lamina in ♀ somewhat cucullate.
- *b.* Rufous .... *C. Brunneri*, Brancs.
- *bb.* Testaceous .... *C. Kershawi*, Tepp.

aa. Subgenital lamina in ♀ not cucullate.
- *b.* Piceous above .... *C. hydrophoroides*, Wlk.
- *bb.* Rufous .... *C. galerucoides*, Wlk. (syn. *C. loftyensis*, Tepp.; *C. apicifera*, Wlk.).

Chorisoneura pectinata, Sauss. (Mél. Orthoptér. iv. p. 131, 1872), may be referred to a new genus, on account of the fusion of the radial and ulnar veins of the tegmina—a condition which obtains also in *Ectobia*, Westw., but not in the genera *Chorisoneura*, Br., or *Choristima*, Tepp., to which it is most nearly allied.

Genus Ectoneura, nov.

Allied to *Choristima*, Tepper, but the radial and ulnar veins of tegmina fused and emitting oblique veins to both margins. Tegmina and wings somewhat reduced in the female, but not to so great an extent as in *Choristima*; triangular apical area large and conspicuous. Supra-anal lamina transverse or slightly produced; subgenital lamina of the male narrow, triangular, of the female large and subquadrate. Femora spineless beneath, except for apical spines, the formula of which is $\frac{1}{0}, \frac{1}{1}, \frac{1}{1}$.

Type, *E. pectinata*, Sauss.

Ectoneura figurata, sp. n.

♂. Head fusco-castaneous with a pale testaceous band

between the eyes; antennæ testaceous. Prothorax transversely elliptical, margins hyaline; disk fusco-castaneous with the centre testaceous, on which are some fuscous markings. Tegmina hyaline with pale fuscous spots along the veins; twelve costal veins, nine discoidal rami. Wings hyaline, veins fuscescent; nine costal veins; medio-discal area twice as broad as medio-ulnar, crossed by several irregular transverse bars; ulnar vein simple; first axillary vein biramose, upper branch irregularly bifurcate. Abdomen fuscous, with testaceous markings; cerci long, fuscous, with a broad testaceous band. Legs testaceous.

Total length 8 mm.; length of tegmina 6·5 mm.

Five males without locality (Oxford Museum).

It is possible that this is the *Blatta marcida* of Erichson, a species placed by Brunner with some doubt in the genus *Ectobia*, Westw.

Genus Chorisoneura, Br.

Chorisoneura Brunneri, sp. n.

♀. Head fuscous, vertex rufo-castaneous; antennæ fuscous at base, the remainder testaceous. Prothorax transversely elliptic, disk fuscous, margins hyaline. Tegmina castaneous with hyaline costal margin and with fuscous humeral vitta, veins white; sixteen costal veins, very irregular; median vein distinct, longitudinal, discoidal vein with four irregular branches; the whole surface of the tegmina is much reticulated, and the veins are rather obscured thereby; the part of the right tegmen covered by the left is infuscated. Wings fuscous, the edge of the marginal field yellowish; eleven costal veins, their ends swollen, joined by transverse bars; medio-discal field crossed by several transverse bars; ulnar vein arcuate, simple; apical triangle unevenly divided, its base acutely angled, its apex subtruncate. Abdomen fulvous, legs testaceous. Cerci long, testaceous.

Total length 8·5 mm.; length of tegmina 7·5 mm.

Rio Grande do Sul. Two examples labelled in Brunner v. Wattenwyl's handwriting "*Chorisoneura*, sp. n." (Oxford Museum).

The species appears to be distinct from anything described; perhaps it shows most affinity with *C. anomala*, Sauss. & Zehnt.

Chorisoneura morosa, sp. n.

♂. Head rufo-fuscous, with a pale narrow transverse line between the eyes; antennæ (mutilated) testaceous;

pronotum with the disk fuscous, margins hyaline. Tegmina pale fulvous, surface not reticulated, veins prominent and white, a fuscous humeral vitta; twelve costal veins, the last two biramose; the humeral vein also giving off four rami to the sutural margin, the discoidal vein giving off only three; ulnar vein triramose. Wings infuscated, edge of marginal field yellow; fourteen costal veins, medio-discal field crossed by numerous transverse bars; ulnar vein forked at apex, axillary vein triramose; apical area unequally divided, acutely angled at base, its apex subtruncate. Body and legs testaceous beneath.

Total length 9 mm.; length of tegmina 7 mm.

Cachabi, Ecuador (W. F. H. Rosenberg coll., Dec. 1896); one example (Oxford Museum).

The species is evidently allied to *C. translucida*, Sauss., from Mexico.

Subfam. *Panchlorinæ.*

Genus Zetobora, Burm.

Zetobora lata, sp. n.

♂. Head black; labrum golden; antennæ at base black, nitid, the rest fuscous, villose. Pronotum with anterior margin strongly rounded in the middle, less so laterally, the margin slightly reflected, the posterior margin only slightly curved, the postero-lateral angles slightly notched; disk with a humeral carina on each side, the "hood" with a few tubercles, nitid, the sides with numerous tubercles of various sizes, a few granules on the front; castaneous except for a testaceous hyaline patch, semicircular in shape, in front; scutellum with central carina and a few punctures. Tegmina broad, scarcely exceeding the abdomen in length, testaceo-hyaline, anal field and humeral vein castaneous; marginal field very broad, its outer border slightly thickened and margined; mediastinal area with large shallow punctures; anal field reticulate-punctate; discoidal field reticulate; apex broadly rounded. Supra-anal lamina quadrate, notched; subgenital lamina produced, rather asymmetrical, with one style (the right). Abdomen castaneous; the dorsal tergites with their posterior angles strongly produced backwards and projecting considerably beyond the sternites, very much as in the genus *Capucina*, Sauss.

Total length 22 mm.; length of tegmina 25 mm.; breadth of tegmen 13 mm.; pronotum 10 mm. × 16·2 mm.

The species is characterized by its great breadth in proportion to its length; the notched postero-lateral angles of the pronotum are also distinctive.

Subfam. *Corydinæ.*

Genus Euthyrrapha.

Euthyrrapha bigeminata, sp. n.

♀. Very similar to *E. pacifica*, Coq., but the pronotum entirely fuscous, a round pale testaceous spot on each tegmen beyond the middle; the abdomen beneath is orange with the apex fuscous. The tegmina at base are slightly rugose, minutely punctate, and furnished with an erect pubescence; the apex of the tegmina appears velvety. Legs fuscous, coxal joints and tibial spines castaneous. Subgenital lamina strongly carinate.

Total length 7·5 mm.; length of body 5 mm.; length of tegmina 6 mm.

Ivory Coast, W. Africa (*G. Thoiré*, 1901); one example (Paris Museum).

Subfam. *Perisphærinæ.*

Genus Paranauphœta, Br.

Paranauphœta Brunneri, sp. n.

♀. Closely allied to *P. rufipes*, Haan, but smaller. Head with three maculæ on the vertex; the ocelli, genæ, clypeus, and basal joints of the palpi testaceous; apical joints of antennæ not testaceous. Pronotum with the testaceous margins much narrower than in *P. rufipes*. Tegmina and wings as in *P. rufipes*. Abdomen above less strongly marked with testaceous; subgenital lamina ample, produced, emarginate. Coxæ testaceous, castaneous at base; femora testaceous at base, remainder castaneous; tibiæ and tarsi rufo-castaneous.

Total length 20 mm.; length of body 18 mm.; length of tegmina 17·1 mm.

Kuching, Sarawak (*Shelford*, 1900); one example (Oxford Museum).

Genus Eustegasta, Gerst.

Eustegasta agrilidina, sp. n.

♂. Black, nitid, with dark green metallic reflections. Head entirely of this colour except the labrum, which is testaceous; antennæ with five basal joints, black, nitid, remainder fuscous. Pronotum of typical form, broadly bordered laterally with orange. Tegmina with an orange spot at base of discoidal area, another in apical third of marginal area. Abdomen above fuscous, broadly margined with orange, beneath orange; supra-anal lamina short, trigonal, fuscous; subgenital lamina small, asymmetrical, without styles, black; cerci pale testaceous. Front legs orange; mid and hind coxæ black, outwardly bordered with white, femora and tibiæ orange, all the tarsi fuscous; front femora with two spines on anterior margin beneath; mid femora with one spine on anterior margin, none on posterior margin; hind femora with one spine on anterior margin, three on posterior margin; formula of apical spines $\frac{1}{0}$, $\frac{1}{1}$, $\frac{1}{0}$; no genicular spine on front femora.

Total length 12·5 mm.; length of body 10 mm.; length of tegmina 10·1 mm.

N'Kogo, French Congo (*H. Bonnet*, 1903); one example (Paris Museum).

The nearest ally of the species is *E. metallica*, Sauss.

Eustegasta variegata, sp. n.

♂. Head testaceous; occiput, a cordate patch on the frons, the genæ, two spots on the clypeus, and the palpi castaneous or black; antennæ black, the six basal joints nitid. Pronotum testaceous, the disk rufo-castaneous, with two black longitudinal vittæ of irregular shape. Tegmina rufo-castaneous; mediastinal area and two thirds of marginal area clear testaceous, the stripe at its termination expanding into a spot that extends on to the outer part of discoidal field; a humeral stripe; the anal vein and a longitudinal stripe in the anal field black, faint indications of a testaceous spot at base of discoidal field. Wings flavo-hyaline; median vein bifurcate; ulnar vein with ten rami, four of which reach the apex of the wing. Abdomen orange above and beneath; supra-anal lamina quadrate, posterior angles acute, not emarginate; subgenital lamina asymmetrical, with one style, the right; cerci orange. Coxæ black, outwardly bordered with testaceous; front femora castaneous, the other femora

and all the tibiæ flavo-testaceous; tibial spines rufo-castaneous, apical joints of tarsi fuscous; femoral spines as in preceding species, except that the mid femora have no spines beneath.

Total length 13·8 mm.; length of body 10 mm.; length of tegmina 10·8 mm.

Congo (*Dybowski*, 1896); two examples (Paris Museum).

Nearest to *E. Lueci*, Dom.

Genus Ellipsica, Sauss. & Zehnt.

Ellipsica rugosa, sp. n.

♀. Black, narrowly elliptical, convex. Head punctate; clypeus, mouth-parts, and antennæ flavo-testaceous. Sides of the thoracic tergites strongly deflexed, their posterior angles acute and produced backwards, their surface beset with tubercles, between which are numerous punctures; on the meso- and metanotum the tubercles are in a double row, on the pronotum they are less regularly placed. Abdominal tergites transversely divided by a sulcus into two unequal portions; the anterior narrow portion is impunctate and smooth, the posterior portion is marked by a double row of punctures followed by a double row of tubercles; the transverse sulci are laterally very deep, especially in the posterior segments, and one row of punctures lies in these sulci; on the seventh tergite the tubercles are larger and less regularly arranged than in the preceding segments. Supra-anal lamina quadrate, margined, tuberculate. Abdominal sternites transversely divided by sulci like the tergites, punctate but not tuberculate; subgenital lamina ample, punctate. Legs black, tarsi flavo-testaceous, arolia large.

Total length 15 mm.; pronotum 5 mm. × 7 mm.

West coast of Madagascar (*Lantz*, 1882); two examples (Paris Museum).

The species is quite unlike any other of the genus in its tuberculate characters.

Genus Pseudoglomeris, Br.

Pseudoglomeris magnifica, sp. n.

♀. Brilliant metallic green or blue-green. Head punctate; eyes 1 mm. apart; base of antennæ and palpi flavid, apical half of antennæ fuscous, middle section castaneous. Pronotum semiorbicular, posterior angles backwardly produced; anterior border margined and slightly

reflected, densely punctate; anteriorly the punctures are irregular, producing a reticulate appearance; a few irregular smooth spaces on all the thoracic tergites; thorax beneath black, shining. Abdomen with large shallow punctures above; lateral margins of fifth and sixth segments slightly sinuate, four or five punctures in the sulci of third to sixth segments; supra-anal lamina quadrate, slightly concave, angles rounded; abdomen beneath æneous, densely punctate, lateral smooth stigmata on each segment; subgenital lamina ample, sinuate, striato-punctate. Cerci rufous. Coxæ, apices of femora, tibiæ, and tarsi rufo-testaceous; femora castaneous.

Total length 23 mm.; pronotum 7·8 mm. × 14 mm.

Tuyen-Quan, Central Tonkin (*A. Weiss*, 1901); a long series of specimens in all stages of growth (Paris Museum).

This is one of the most brilliantly-coloured cockroaches known to science; its colour is reminiscent of the gorgeous metallic-green Cetoniid beetles of the Eastern Tropics.

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Some new Genera and Species of Blattidæ, *with Notes on the Form of the Pronotum in the Subfamily* Perisphæriinæ.

By R. Shelford, M.A., F.L.S.

[Plates IX. & X.]

Subfam. *Ectobiinæ.*

Genus Anaplecta, Burm.

Anaplecta erythronota, sp. n. (Pl. IX. fig. 9.)

♀. Head and disk of pronotum rufous. Lateral margins of pronotum hyaline. Tegmina castaneous, with the marginal area hyaline; 10 costals, 3 longitudinal discoidal sectors. Wings infuscated, marginal area not dilated, radial vein with a humeral and discoidal branch; 6 to 7 costals, median vein obsolete at base; medio-discal field twice as broad as medio-ulnar and crossed by 7 transverse venulæ; medio-ulnar field distally crossed by 2 to 3 transverse venulæ, first axillary triramose; apical area parabolic, two fifths of total wing-length, base slightly obtusely angled, crossed below the middle by an oblique vein. Abdomen beneath, cerci, and legs testaceous; abdomen above castaneous, supra-anal lamina transverse, narrow.

Total length 8 mm.; length of tegmina 5·4 mm.

Maskeliya, Ceylon (*E. E. Green*). Type in the British Museum.

Close to *A. maculata*, mihi, but differs in the wing-venation as well as in the colour of the pronotum.

Subfam. *Phyllodromiinæ.*

Genus Ischnoptera, Burm.

Ischnoptera longstaffi, sp. n. (Pl. IX. fig. 8.)

♂. Testaceous. Head with a castaneous macula on the frons. Pronotum with two castaneous spots on the disk. Tegmina with radial vein bifurcated; 14 to 15 costals, 9 longitudinal discoidal sectors, the anterior ulnar vein being triramose. Wings hyaline, mediastinal vein triramose, radial vein bifurcated; 7 costals, the last two multiramose; ulnar vein with 3 complete branches and 3 or 4 incomplete branches going to the dividing vein, the more proximal minute. Sixth abdominal tergite with posterior border notched, a circular depression at base of seventh tergite marking the opening of

the scent-glands. Supra-anal lamina triangular; subgenital lamina irregularly produced, notched on the left side, with two slender styles. Front femora armed on anterior margin beneath with a complete row of spines, the distal shorter than the proximal; all the femora with genicular and apical spines.

♀. Similar, but supra-anal lamina more produced, subgenital lamina ample, semiorbicular.

♂ ♀. Total length 18–19 mm.; length of body 15 mm.; length of tegmina 15 mm.; pronotum $3{\cdot}5 \times 4{\cdot}9$ mm.

3 ♂ ♂, 2 ♀ ♀, Zambesi rain-forest (*Dr. G. B. Longstaff and Prof. T. Hudson Beare*).

Types in Oxford Museum.

The species is allied to *I. bimaculata*, Gerst., from E. Africa, but differs in the secondary sexual characters of the male.

Subfam. *Blattinæ.*

Genus Protagonista, nov.

Antennæ slightly incrassated. Position of antennal sockets variable. Pronotum as long as broad, quadrangular, with rounded angles, sides not deflexed. A fine erect pubescence covers both pronotum and tegmina. Tegmina and wings fully developed in the male. Tibial spines in two rows. Posterior metatarsus longer than the remaining joints, all the pulvilli apical. Arolia minute.

The genus is remarkable on account of the shape of the pronotum and the pubescence on pronotum and tegmina. In one of the species the eyes are closer together than the antennal sockets, in the other they are further apart; I doubt if this character is of much importance, and it hardly seems advisable to separate the New-World genera of Blattinæ from the Old-World genera on the strength of this character alone.

Protagonista lugubris, sp. n. (Pl. IX. fig. 1.)

♂. Piceous. Head finely punctate; labrum, clypeus, and palpi testaceous; ocelli * prominent, testaceous; eyes further apart than antennal sockets. Antennæ fuscous, slightly incrassated, pubescent, but not plumose, apical joints testaceous. Pronotum not covering vertex of head, coarsely reticulate-punctate, with some smooth interspaces and lines; a deep, wide, semilunar impression extending across the

* They appear to be true ocelli as in the subfam. Corydiinæ, and not *fenestræ* as in the other subfamilies.

anterior third and down the sides to near the posterior angles; a short transverse impression just behind the anterior margin. Tegmina exceeding the apex of the abdomen, semicorneous and seriately punctate at base, marginal field deflexed at base and fimbriate, anal vein obsolescent. Abdomen with disk rufo-castaneous; supra-anal lamina subquadrate, posteriorly emarginate; subgenital lamina subquadrate, with a pair of long styles. Cerci moderate, rufous. Legs rufo-castaneous, the tibiæ with a fine recumbent pubescence. Front femora with a complete row of spines on front margin beneath, none on posterior margin; mid and hind femora somewhat rounded beneath and with only one spine on each margin. Tibial spines sparse, arranged in two rows. Posterior metatarsus very long, succeeding joints rather short.

Total length 25 mm.; length of body 23·5 mm.; length of tegmina 19 mm.; pronotum 5·9 × 6 mm.

Manson Mts., Tonkin (type in Oxford Museum); Yen-Bai, Central Tonkin (co-type in Paris Museum).

Protagonista borneensis, sp. n. (Pl. IX. fig. 2.)

♂. Head piceous, opaque, with a few scattered punctures, mouth-parts piceous; eyes closer together than antennal sockets. Antennæ with moniliform joints, shorter than the body, piceous, with a testaceous band near the apex. Pronotum opaque piceous, with scattered erect pubescence; a shallow transverse impression in anterior third and two oblique impressions in posterior third. Tegmina rufo-castaneous, exceeding the apex of the abdomen, narrow; marginal field narrow, deflexed; anal vein well-marked, reaching nearly halfway down the sutural margin. Abdomen piceous, with the basal segments rufescent above, testaceous below. Supra-anal lamina quadrately produced, posterior angles spiniform, posterior margin concave, exceeded by the subgenital lamina, which is semiorbicular, and provided with a pair of slender styles. Cerci long, acuminate, castaneous. Front legs castaneous, mid and hind legs with the coxæ (except at the base) and the femora (except at the apex) testaceous, otherwise castaneous. Front femora with a complete row of spines on anterior margin beneath, two or three on posterior margin; mid and hind femora with 5 to 7 spines on each margin. Tarsal aroliia larger than in the preceding species.

Total length 25 mm.; length of body 20 mm; length of tegmina 20 mm.; pronotum 4·8 × 4·1 mm.

Sarawak, Borneo (*Shelford*). Type in Oxford Museum.

Genus Archiblatta, Voll.

? *Archiblatta parva*, sp. n.

♀. Rufo-testaceous, all the segments margined and speckled with castaneous. Head castaneous, the vertex paler, finely punctate, nitid; antennæ and mouth-parts rufo-castaneous, antennæ slender, setaceous [mutilated]. Eyes further apart than antennal sockets. Upper surface of body scabrous, nitid. Pronotum trapezoidal, anteriorly truncate, posterior margin slightly obtusely angled; posterior angles of all the thoracic tergites slightly produced. Posterior angles of abdominal tergites not produced; supra-anal lamina subquadrate, posteriorly emarginate, angles rounded, dark castaneous in colour, margined with testaceous. Body beneath and legs uniform castaneous, abdominal sternites laterally scabrous; antepenultimate sternite with a large deep puncture on each side, bordering the subgenital valves. Cerci shorter than the supra-anal lamina. Front femora with a complete row of spines on anterior margin beneath, one on the posterior margin; mid femora with 4–5 spines on anterior, 2–3 on posterior margin; hind femora with 4 spines on anterior, 1 on posterior margin; all these spines very small. Tibial spines in three rows, but the middle row very incomplete. Posterior metatarsus equal to remaining joints; pulvilli large, occupying nearly the entire length of every joint.

Total length 23 mm.; pronotum 6 × 8·5 mm.

Towranna plains, W. Australia (*E. Clement*). Type in Oxford Museum.

I place this very curious insect provisionally in *Archiblatta*, but in many of its characters it does not conform to that genus, and eventually it may be necessary to erect a new genus for its reception.

Subfam. *Corydiinæ*.

Genus Cardax, nov.

♂. Minute, slender, with fine recumbent pubescence. Antennæ nearly as long as body, finely pubescent. Ocelli present. Head with vertex covered by the pronotum; eyes wide apart; frons slightly inflated. Lacinia of maxillæ slender. Pronotum trapezoidal, bent downwards, forming an angle with rest of body, a broad transverse impression at its base. Scutellum exposed. Tegmina extending considerably beyond apex of abdomen, delicate, membranous, hyaline, finely fimbriate, and with minute recumbent pubescence;

radial vein bifurcate from near base, costal veins absent, anterior ulnar simple, posterior ulnar simple or bifurcate, anal field much reduced, anal vein straight, oblique, one axillary vein. Wings similar in size, texture, and pubescence to the tegmina; posterior part of the wing reduced to a small lobe, not pubescent, with one obsolescent axillary vein; radial vein simple, no costal veins; median vein bifurcate from near base, its anterior branch bifurcating near apex; ulnar vein bifurcate. Vena spuria present in both tegmina and wings. Supra-anal lamina subquadrate, posterior border arcuately emarginate. Subgenital lamina rounded, slightly irregular, without styles. Cerci elongate, nine-jointed, apical joint acuminate. Legs slender, long; tibiæ sparsely spined, the spines on the posterior pair biseriately arranged; femora with genicular spines; tarsal claws minute, without arolia; no pulvilli; posterior metatarsus longer than the remaining joints.

Cardax willeyi, sp. n. (Pl. IX. figs. 3–7.)

♂. Fusco-hyaline; tegmina with a slight iridescent sheen; legs testaceous. Front tibiæ with four apical spines, otherwise unarmed; mid tibiæ with two spines near the base and three apical spines; hind tibiæ with four spines along the outer border and three apical spines.

Total length 5·9 mm.; length of body 3·8 mm.; length of tegmina 5 mm.; greatest breadth of tegmina 2 mm.

Peradeniya, Ceylon (*A. Willey*); several specimens. Type in the British Museum; co-type in the Oxford Museum.

This is certainly one of the most remarkable cockroaches known. In general appearance it is far more like a small Neuropterous insect than like an Orthopteron, an effect brought about by the similar texture and pubescence of the tegmina and wings; this is a feature shown, to a limited extent, by the genus *Homopteroidea*, mihi, but by no other genera in the family. In the subfamily Corydiinæ the posterior part of the wing does not fold up in a fan-like manner, but merely doubles under the anterior part, which leads in some instances to a reduction in size of the posterior part, so that it becomes equal in size or even smaller than the anterior part. In *Cardax* the reduction has proceeded so far that the posterior part of the wing is represented merely by a small functionless lobe; and it is interesting to note that, correlated with this reduction, is a parallel reduction of the anal field of the tegmina. The anterior part of the wings is relatively much larger than is usual in Blattidæ. The venation of the

alar organs is much simplified and approximates to a radiate type, there being but little branching of the veins. The minute tarsal claws constitute another highly remarkable character. It is difficult to discover the affinities of a genus so aberrant as this; the biseriate arrangement of the tibial spines shows that it must be placed in the section of the subfamily which embraces *Latindia*, Stål, *Paralatindia*, Sauss., *Homopteroidea*, Shelf., &c.; but it cannot be regarded as closely related to any known genus.

Subfam. *Perisphæriinæ.*

The Form of the Pronotum in the Perisphæriinæ.

De Saussure and Zehntner, in their revision of the Perisphæriinæ (Rev. Suisse Zool. vol. iii. 1895), have traced the evolution of the complex type of pronotum of such genera as *Pilema* and *Cyrtotria* [= *Stenopilema*, Sauss.] from a simple type. A summary of their conclusions may be presented here, and I have added some diagrammatic figures as a help to its elucidation. In a typical Blattid pronotum two areas may be distinguished, the disk and the lateral wings, which project on either side beyond the outer limits of the prosternum; the disk covers the head and on the *underside* is more or less defined by a pair of carinæ, known as the typical carinæ. In transverse section this form of pronotum may be represented as in Pl. IX. fig. 10, A, where *a* represents the disk, *b b* the lateral wings, and *c c* the typical carinæ. In the genus *Pronaonota* (Pl. IX. fig. 10, B) the lateral wings are strongly bent downwards and an incomplete carina (*d*) on the deflected sides of the dorsal surface of the pronotum foreshadows the separation of the lateral wings from the disk. The separation is more or less complete in the genera *Pilema* and *Cyrtotria* (Pl. IX. fig. 10, C); the lateral wings in these genera now appear in side view as lateral bands bent down at a right angle, or at more than a right angle, to the disk of the pronotum, and their upper (morphologically inner) border is elevated, so that in dorsal view it appears as if the lateral borders of the pronotum had been simply reflected from below upwards. Such, however, is not really the case; the carina on the pronotum of *Pronaonota* is the morphological equivalent of the upper edge of the lateral band of *Pilema*, and the lateral margin of the pronotum of *Pronaonota* is the equivalent of the lower edge of the lateral band of *Pilema*. This lateral band is morphologically the lateral wing of the pronotum, which has become divided off from the disk,

rotated outwards through some degrees, and, owing to a greater or less elevation of its upper border, is now separated dorsally from the disk of the pronotum by a channel or groove of varying depth. Frequently, though by no means always, the development of the lateral bands is accompanied by a slight upward reflection of the anterior margin of the pronotum. The upper edge of this reflected border is continuous with the upper edge of the lateral bands; the lower edge, when seen from the ventral aspect, is occasionally continuous with the lower edge of the lateral bands, as in *Cyrtotria jallæ*, Gig.-Tos (Pl. X. fig. 19), in which case the lateral bands are connected anteriorly with each other, but more frequently the lower edge of the anterior reflection is not evident and the lateral bands are not connected with each other anteriorly (Pl. X. fig. 13).

In the species of the genus *Bantua* (Pl. IX. fig. 10, D), the rotation of the lateral bands has been carried still further, *i. e.* outwards, downwards, and then inwards, so that now the lateral bands form a very acute angle with the disk of the pronotum and lie underneath it; the gutter or channel is obliterated, just as a fold in a piece of cloth vanishes when the part of the cloth involving the fold is tightly wrapped round some solid object. The outer border of the pronotal disk is now the outer margin of the pronotum. A new species of *Pilema* and a new species of *Bantua* described below illustrate in a most striking and interesting manner the rotation of the lateral bands of the pronotum, with concomitant obliteration of the gutter separating the bands from the disk. Finally, in the genus *Derocalymma* (Pl. IX. fig. 10, E) the lateral bands are bent still further under the disk and lie in almost a parallel plane with it; at the same time the pronotum is broader, it has reverted to the primitive flattened shape, but its outer lateral margins are now not the morphological equivalents of the outer lateral margins of the primitive type, but the equivalents of the inner boundaries of the lateral wings of that.

The whole series of specimens illustrates admirably the evolution of a complex type of pronotum from a simple type, the former superficially resembling the latter. It is by no means often that the entomologist is supplied with such a series of gradations, and it is generally far easier to hazard a suggestion as to the value to the species of certain structures, than to elucidate their mode of origin. Here it is otherwise; we can see pretty clearly the steps whereby the pronotum of *Derocalymma* evolved from a more primitive type, but the value to the species of these variations in structure is by no

means evident at first sight. A knowledge of the habits of an animal should invariably precede all suggestions as to the value of any details of its structure, and I feel convinced that much of the mystery surrounding variations in structure which are spoken of as being merely of importance to the systematic naturalist will be dispelled as our knowledge of the life-histories of the animals exhibiting them increases. A clue to the use of the variations in pronotal structure of the cockroaches under notice is afforded by the observations, slight and incomplete though they are, on their habits. The vast majority of Blattidæ are insects of cryptic habits, spending most of their life hidden under stones or logs, in decaying vegetation, burrowing in rotten wood, and so forth, and the majority of species are flattened depressed insects. The species of *Pilema*, on the other hand, are convex and more or less cylindrical insects with a large heavy pronotum, the anterior border of which is often slightly reflexed and bounded laterally by the upwardly projecting lateral wings.

Mr. Distant, in his 'Insecta Transvaaliensia,' has recently published an interesting field-observation on the habits of a species identified as *Pilema thoracica*, Walk. A female accompanied by several larvæ was taken from the bottom of a neat round hole in the ground about 6 inches in depth; there were half a dozen such holes in about half an acre, and all contained families of this species. I have no doubt but that all the species of this genus have adopted this mode of life, and that the pronotum is the part of the body that is used in excavating the burrows, for on examining some specimens of *P. reflexa*, Walk., and *P. hebetata*, Sss. & Z., in the British Museum, I found that in these the channel between the pronotal disk and lateral bands was simply choked with earth. It is not unreasonable to assume that the heavy shovel-like pronotum of *Pilema* has been evolved in response to a change of habitat. Turning now to the other end of the series of cockroaches considered, we find that the species of *Derocalymma* are the most flattened members of the whole family, and in correspondence with this depressed form it is no surprise to learn that they live under heavy stones. The advantage of the flattened form, enabling the insects to slip through narrow crevices and to lie in security in a circumscribed shelter beneath a stone too heavy for any but a relatively powerful enemy to move, is obvious; and, again, it is not unreasonable to assume that the highly modified pronotum of *Derocalymma* is a result of a change of habitat. There is no information forthcoming as to the habits of *Bantua* and *Cyrtotria*; some species of the

latter genus have the pronotum well adapted for digging, but others have not, and it would be of the greatest interest to learn if the habits of the species vary in correlation with the form of the pronotum.

Bantua is intermediate in structure between *Cyrtotria* and *Derocalymma*; some specimens collected by Dr. Longstaff in S. Africa were taken from beneath a log, which means, I expect, that they were lurking in the rubbish immediately surrounding the log, as they are not adapted, like *Derocalymma*, for life beneath a heavy body, judging by their facies.

Finally, the question arises, has *Derocalymma* originated from a form like *Pilema*, passing in the course of its evolution through a *Bantua*-like stage? One is tempted to answer in the affirmative, for adaptation to life beneath stones could have been brought about by mere flattening of a generalized type of cockroach with a simple form of pronotum, as has indeed occurred in the Australian genus *Oniscosoma*, superficially similar to *Derocalymma*, but structurally widely different. The highly modified pronotum of *Derocalymma* has resulted from the flattening not of a simple form of pronotum, but of a complex form with lateral bands; the lateral bands in *Pilema* are the most essential parts of the excavating organ, the pronotum; but they can serve no useful purpose in species that do not burrow into the ground, and the manner of their modification in response to a different habit of life is shown in the genus *Bantua*, and especially in the new species of that genus described below, the final step in the process being exhibited by *Derocalymma*.

Genus Bantua, nov.

Cyrtotria, Saussure and Zehntner (nec Stål), Rev. Suisse Zool. iii. p. 28 (1895).

Differs from *Pilema*, Sauss., and *Cyrtotria*, Stål, in the form of the pronotum, the lateral bands being bent under the disk and forming an acute angle with it; the margin of the pronotal disk forms the outer margin of the pronotum. In the female the posterior angles of the pronotum are more or less produced backwards. Differs from the genus *Derocalymma*, Burm., by the less complete bending under of the lateral bands of the pronotum, by the membranous tegmina of the male, and the backwardly produced posterior angles of the pronotum in the female.

Type of genus. *Perisphæria dispar*, Burm.

Bantua ferox, sp. n. (Pl. X. fig. 25.)

♀. Piceous, nitid. Head cribrate-punctate; distance apart of eyes less than length of first antennal joint; antennæ castaneous; ocelli, labrum, and maxillary palpi rufo-testaceous. Pronotum rugose, lateral bands anteriorly deflected inwards, posteriorly strongly produced backwards, and bent downwards at a right angle to the disk of the pronotum; a broad channel dorsally separates the posterior part of the band from the disk; the disk of the pronotum anteriorly is tuberculate, posteriorly with a few deep punctures, posterior margin dentate. Mesonotum rugose, cribrate-punctate; posterior angles tumid, produced, anterior angles depressed and fitting beneath the posterior angles of the pronotum. Metanotum less deeply punctate; posterior angles tumid, produced. Abdomen rather wider than thorax, finely punctate above and beneath, a narrow anterior zone on each tergite and sternite impunctate; supra-anal lamina trapezoidal, posterior margin slightly reflected. Cerci testaceous.

Total length 27·8 mm.; pronotum 8 × 10 mm.

Nyika Mts., 6000–7000 feet, Nyasaland (*A. Whyte*, July 1896).

Type in the British Museum.

The pronotal structure of this species is of great interest, for whilst anteriorly the lateral bands lie under the disk, forming a very acute angle with it, as is characteristic of a typical *Bantua*, posteriorly they are vertical and form more or less of a right angle with the disk, as is characteristic of a typical *Pilema*. Correlated with this torsion of the lateral bands is the entire absence of the pronotal gutter or channel anteriorly, whilst posteriorly it is deep and plainly visible. The structure illustrates quite clearly that the bending under the disk of the lateral bands brings about the obliteration of the gutter; speaking rather metaphorically, the material of which the pronotum is composed is stretched taut by the rotation inwards of the lateral bands, so that the fold in the material disappears; where the rotation is of less extent there is enough material to form a fold or channel. A diagrammatic section through the front part of the pronotum of *B. ferox* will resemble Pl. IX. fig. 10, D, but a similar section through the hinder part will resemble Pl. IX. fig. 10, C.

Genus Pilema, Sauss.

Pilema mombasæ, sp. n. (Pl. X. figs. 22, 23.)

♀. Piceous, nitid. Head with face rugose and slightly

punctate; eyes very close together; antennæ and labrum castaneous, maxillary palpi rufo-testaceous; ocelli not visible. Pronotum above with disk rugose, punctate and anteriorly tuberculate; anteriorly obtusely carinate, anterior margin reflected slightly, lateral bands anteriorly deflected downwards, but not so much as in *Bantua ferox*; the channel between the disk and the lateral bands wide and shallow; posteriorly the lateral bands are produced as in *Pilema dentata*, Sauss. & Zehnt.; posterior margin dentate. Meso- and metanotum cribrate-punctate, with smooth interspaces and a median carina, posterior angles slightly produced. Abdomen not wider than thorax, obsoletely punctate above and beneath; an anterior zone on each tergite and sternite impunctate; supra-anal lamina trapezoidal. Cerci and legs castaneous.

Total length 28 mm.; pronotum 8·5 × 8·9 mm.

Mombasa (1 ♀).

Type in the British Museum.

The species is in its pronotal structure intermediate between *Bantua ferox* and typical *Pilema*.

Genus Cyrtotria, Stål.

Stenopilema, Sauss. Ann. Mus. Civ. Genova, xxxv. p. 87 (1895); Sauss. & Zehnt. Rev. Suisse Zool. iii. p. 25 (1895).

Thysanoblatta, Kirby, Ann. & Mag. Nat. Hist. (7) xii. p. 380 (1903).

The type of the genus is *C. gibbicollis*, Stål, and this species is undoubtedly congeneric with the species included in *Stenopilema* by de Saussure and Zehntner. *Thysanoblatta* was founded on a species characterized by an erect pubescence, but otherwise differing in small details only from typical species of *Stenopilema*; and I have no hesitation in sinking it as a synonym of *Cyrtotria*. There has been an excessive multiplication of genera in this subfamily of Blattidæ, and much confusion has resulted therefrom.

The species of *Cyrtotria* are very difficult to identify from descriptions, for it is not easy to express in writing the subtle differences in the form of the pronotum presented by the different species. I have examined nearly all the types, and have drawn up a synoptical key to the species, which, together with the figures, will I hope render the determination of the species easier than heretofore.

Two species of the genus, *C. latipennis*, Kirby, and *C. pallicornis*, Kirby, present a remarkable modification of the pronotum, which appears to have been overlooked by the describer. The disk of the pronotum on each side is perfo-

rated by three (*latipennis*) or two (*pallicornis*) pores of relatively large size and semilunar in shape; the tongue of chitin projecting into the crescentic pores is tuberculate in *pallicornis*, but simple in *latipennis*. It is difficult even to guess at the function of these pores. Since they occur in both sexes, it is evident that they are not secondary sexual structures; but it is just possible that they are connected with prothoracic repugnatorial glands, though such have not yet been shown to occur in the Blattidæ. The pronotal integument appears to be double in the region of these pores, and the pores appear to lead into a cavity existing between the upper and lower layers, and not to perforate the entire integument, for a bristle passed through one of them does not emerge on the ventral side of the pronotum. Without dissection it is not possible to be certain as to the relation of the parts, and the pores may be merely the entrances to invaginated cavities in the thickness of the pronotal chitin.

Key to the Species.

Males.

1. Pronotum and abdomen with erect pubescence.
  2. Pronotum with large lateral pores .... *latipennis*, Kirby. (Brit. E. Africa.)
  2'. Pronotum without large lateral pores.. *macra*, Stål. (S. Africa.)
1'. Pronotum and abdomen not pubescent.
  2. Posterior margin of pronotum dentate . *scabricollis*, Gerst. (Gaboon.)
  2'. Posterior margin of pronotum not dentate.
    3. Tegmina scarcely exceeding the apex of the abdomen .... *gibbicollis*, Stål. (Natal.)
    3'. Tegmina considerably exceeding the apex of the abdomen.
      4. Small species (total length about 38 mm.) .... *poduriformis*, Walk. (S. Africa.)
      4'. Larger species.
        5. Tegmina pale testaceous, castaneous at base .... *capucina*, Gerst. (Germ. E. Africa, Somaliland.)
        5'. Tegmina uniform castaneous .. *marshalli*, sp. n. (Rhodesia.)

Females.

1. Body slender, elongate: species of small size.
  2. Pronotum much longer than broad .... *poduriformis*, Walk. (S. Africa.)
  2'. Pronotum scarcely longer than broad or as broad as long.
    3. Abdominal segments scabrous ...... *graniger*, Sauss. & Zehnt. (Somaliland.)
    3'. Abdominal segments smooth ...... *nyasæ*, sp. n. (Nyasaland.)
1'. Body less slender, abdomen sometimes ampliated: species of larger size.
  2. Pronotum distinctly broader than long.

3. Lateral bands of pronotum narrow, no pores in pronotal channel ...... *gibbicollis*, Stål.
3′. Lateral bands of pronotum broader, two large pores in pronotal channel. *pallicornis*, Kirby. (Transvaal.)
2′. Pronotum as long as broad or longer than broad.
3. Lateral bands of pronotum very broad, anterior margin reflected .. *jallæ*, Gig.-Tos. (Upper Zambesi, Port. E. Africa.)
3′. Lateral bands narrower.
4. Lateral bands closely adpressed to disk of pronotum............. *capucina*, Gerst.
4′. Lateral bands not closely adpressed to disk of pronotum.
5. Lower border of lateral bands not dentate .... *marshalli*, sp. n. (Rhodesia.)
5′. Lower border of lateral bands dentate .... *scabricollis*, Gerst. (West Africa.)

Species of doubtful position.

Perisphæria fusca, Burm., and *P. gracilis*, Burm.

1. *Cyrtotria latipennis*, Kirby. (Pl. X. fig. 21.)

Thysanoblatta latipennis, Kirby, Ann. & Mag. Nat. Hist. (7) xii. p. 380 (1903).

The following may be added to the original description:—

♂. Eyes touching on vertex of head. Palpi, margin of labrum, ocelli, and base of antennæ testaceous. Head castaneous, punctate. Pronotum coarsely reticulate-punctate, with some smooth interspaces; lateral bands rather narrow, not closely adpressed to disk, channel wide and shallow; three large crescentic pores on each side of the disk; posterior margin slightly dentate, anterior margin slightly reflected; disk anteriorly carinate.

Length of body 20·8 mm.; length of tegmina 21 mm.; pronotum 6·1 × 6 mm.

British E. Africa.

Type in the British Museum.

2. *Cyrtotria macra*, Stål. (Pl. X. fig. 11.)

Ischnoptera macra, Stål, Œfv. Vet.-Akad. Förh. xiii. p. 165 (1856).
Derocalymma (*Cyrtotria*) *macra*, Stål, *l. c.* xxviii. p. 380 (1871).

Description of type.—♂. Head castaneous; eyes close together, their distance apart equal to the breadth of the first antennal joint. Pronotum reticulate-punctate, with a long erect scattered pubescence, pale testaceous in colour. Lateral bands of pronotum not very broad, closely applied to the disk, channel very narrow. Tegmina hyaline, castaneous at base.

Wings hyaline; ulnar vein 8-ramose, only three of the branches being complete. Abdomen castaneous, ventrally with scattered erect pubescence. Legs testaceous, with scattered erect hairs.

Total length 15·9 mm.; length of body 12 mm.; length of tegmina 11·8 mm.; pronotum 3·1 × 3 mm.

Hab. Caffraria (*J. Wahlberg*).

Type in Stockholm Mus.

This is one of the smallest species of the genus.

3. *Cyrtotria gibbicollis*, Stål. (Pl. X. fig. 12.)

Ischnoptera gibbicollis, Stål, Œfv. Vet.-Akad. Förh. xiii. p. 165 (1856).
Perisphæria elateroides, Walker, Cat. Blatt. Brit. Mus. p. 176 (1868).
Perisphæria linearis, Walker, *l. c.* p. 176 (1868).
Perisphæria cylindrica, Walker, *l. c.* p. 176 (1868).
Derocalymma (*Cyrtotria*) *gibbicollis*, Stål, *l. c.* xxviii. p. 380 (1871).

♂ (type). Head castaneous; eyes approximate; mouth-parts testaceous; antennæ infuscated, testaceous at base. Pronotum as broad as long, coarsely cribrate-punctate, with smooth interspaces; castaneous, anteriorly testaceous; lateral bands narrow, not very closely adpressed to disk, an anterior carina. Tegmina not exceeding the body by much, rufo-castaneous in basal third, remainder flavo-hyaline; veins testaceous. Wings clear hyaline; ulnar with ten branches, eight of which are incomplete. Abdomen castaneous, margined with testaceous; subgenital lamina irregular, with one style; cerci flavo-testaceous. Femora and coxæ rufo-castaneous; tibiæ and tarsi testaceous.

♀ (type). Piceous, nitid, sparsely punctate. Head piceous, mouth-parts and antennæ testaceous. Lateral borders of pronotum very narrow, scarcely elevated, closely adpressed to disk; no anterior carina. Abdomen slightly ampliated; supra-anal lamina trapezoidal; cerci very short, flavid; legs rufo-castaneous.

♂. Total length 16·8 mm.; length of body 14 mm.; length of tegmina 14 mm.; pronotum 4·9 × 5 mm.

♀. Total length 13 mm.; pronotum 3·5 × 4·5 mm.

Caffraria (*J. Wahlberg*, types in Stockholm Museum); Natal (*elateroides*, *cylindrica*, and *linearis*, types in British Museum); Colenso (*G. Longstaff*, Oxford Museum).

I have compared the types of all the species enumerated in the synonymy, and though at first I was inclined to regard *cylindrica* as distinct, I have now come to the conclusion that it is a fully adult form, whereas *gibbicollis* was described from an incompletely mature form. I have had the

advantage of examining a very long series of *C. capucina*, Gerst., taken by Dr. Y. Sjöstedt in the Kilimanjaro district, and I am convinced that the shape of the abdomen (ampliated or not ampliated) is a character of no importance in discriminating between species of this genus, for it varies with the age of the insect and is largely affected by the way in which the specimens are dried or killed. Some of Dr. Sjöstedt's examples were almost completely cylindrical, others had the abdomen distinctly ampliated; yet there could be no doubt that all were referable to the same species. Similarly, apart from its size and the shape of the abdomen, *C. cylindrica*, Walk., differs in nowise from *C. gibbicollis*, Stål.

4. *Cyrtotria capucina*, Gerst. (Pl. X. fig. 13.)

Derocalymma capucina, Gerstaecker, Arch. Naturg. xxv. p. 207 (1861); Von der Decken, Reis. in Ost-Afrika, iii. (2) p. 8, pl. i. fig. 4 (1873).
Stenopilema somali, Saussure, Ann. Mus. Genova, xxxv. p. 88 (1895); Saussure and Zehntner, Rev. Suisse Zool. iii. p. 27 (1895).

To be distinguished from *C. gibbicollis*, Stål, by the antennæ testaceous at the base, by the proportions and shape of the pronotum, the lateral bands of which are broader and anteriorly are more separated from the disk. I have examined the type of *C. somali*, Sauss., which proves to be identical with Gerstaecker's species.

♀. Total length 18–18·5 mm.; pronotum 5×5 mm.

The male will be described in a forthcoming memoir on the Blattidæ of Mt. Kilimanjaro.

Hab. German East Africa, Mt. Kilimanjaro, and Somaliland.

Type of *capucina* in the Berlin Museum; type of *somali* in the Museo Civico di Storia Naturale, Genoa.

5. *Cyrtotria pallicornis*, Kirby. (Pl. X. fig. 16.)

Stenopilema pallicornis, Kirby, Ann. & Mag. Nat. Hist. (7) v. p. 290 (1900).

The following may be added to the original description:—

♀. Piceous, nitid, cribrate-punctate. Head and antennæ castaneous, mouth-parts rufo-castaneous. Pronotum slightly broader than long; lateral bands narrow, slightly elevated, not closely adpressed to disk; pronotal channel wide; two large crescentic pores, close together, on each side of the disk; posterior angles produced, disk anteriorly carinate. Abdomen less strongly punctate than the thorax. Coxæ and femora piceous; tibiæ rufo-castaneous; tarsi testaceous.

Total length 13 mm.; pronotum $4{\cdot}5 \times 6$ mm.

Pretoria (*W. L. Distant*); Zoutpansberg, Transvaal (*J. P. Cregoe*).

Type in the British Museum.

6. *Cyrtotria poduriformis*, Wlk. (Pl. X. fig. 14.)

Perisphæria poduriformis, Walker, Cat. Blatt. Brit. Mus. p. 175 (1868).
Perisphæria poduroides, Walker, *l. c.* p. 175 (1868) (larva).
Stenopilema macilenta, Saussure and Zehntner, Rev. Suisse Zool. iii. p. 26, pl. i. fig. 3 (1895).

I have compared the types of *poduriformis* and *macilenta*, and find them to be identical; *poduroides* is a larva. It is possible that the species is the same as *gracilis*, Burm., but I cannot be certain on this point without consulting Burmeister's type. The small size, narrow cylindrical shape, the somewhat flattened pronotum, much longer than broad and with the lateral bands adpressed to the disk at the base only, are the chief characters of this species. I append a description of what I consider to be the male of this species:—

♂. Rufo-castaneous. Head castaneous, distance apart of eyes equal to breadth of first antennal joint. Pronotum coarsely cribrate-punctate, with a few smooth interspaces, carinate throughout its length, lateral bands not closely adpressed to the disk; posterior angles not produced, anterior and posterior margin slightly reflexed. A very fine, short, erect pubescence on the disk of the pronotum. Tegmina considerably exceeding the apex of the abdomen, paler towards apex. Abdomen castaneous beneath, except at base, which is testaceous. Legs and cerci testaceous.

Total length $37{\cdot}5$ mm.; length of body 15 mm.; length of tegmina 15 mm.; pronotum 4×3 mm.

Damaraland; Natal; Cape Colony.

♂ type in the Oxford Museum; ♀ type of *poduriformis* in British Museum; ♀ type of *macilenta* in Geneva Museum.

7. *Cyrtotria graniger*, Sauss. & Zehnt.

Stenopilema graniger, Saussure and Zehntner, Rev. Suisse Zool. iii. p. 26 (1895).

I do not know where the type of this species has been deposited; it is not in the Geneva Museum. The key to the species shows how *graniger* may be distinguished from its ally *poduriformis*.

8. *Cyrtotria marshalli*, sp. n. (Pl. X. fig. 15.)

♂. Castaneous. Head piceous; ocelli, basal joint of antennæ, and mouth-parts testaceous. Eyes approximated. Pronotum as long as broad, punctate and rugulose; anterior margin scarcely reflected; lateral bands narrow, not adpressed to the disk of the pronotum, posterior margin slightly elevated, posterior angles not produced. Tegmina not exceeding body by much, apical half hyaline suffused with castaneous; veins fuscous. Wings hyaline, anterior part suffused slightly with castaneous; ulnar vein with nine branches, only three of which reach the apex of the wing. Abdomen above testaceous at base, becoming castaneous towards apex, beneath castaneous; supra-anal lamina subquadrate, angles rounded, subgenital lamina produced, irregular, margined with testaceous; one style. [Cerci mutilated.] Legs rufo-castaneous.

♀. Piceous, nitid, cribrately punctate. Head piceous, mouth-parts castaneous. Pronotum with lateral bands moderately broad, not adpressed to disk of pronotum, anterior margin scarcely reflected, pronotal channel broad and shallow, posterior angles produced, disk anteriorly with a slight keel. Abdomen posteriorly slightly ampliated. Coxæ piceous; femora and tibiæ castaneous.

♂. Total length 26 mm.; length of body 22·5 mm.; length of tegmina 20 mm.; pronotum 5 × 5 mm.

♀. Total length 22 mm.; pronotum 6 × 6 mm.

Salisbury, Rhodesia (*G. A. K. Marshall*), 3 ♂ ♂ and 1 ♀.

Types (♂ and ♀) in the Oxford Museum.

Allied to *C. poduriformis*, but differs, *inter alia*, by its much larger size.

9. *Cyrtotria nyasæ*, sp. n. (Pl. X. fig. 17.)

♀. Piceous, nitid, narrow and cylindrical. Head castaneous, with very few punctures; eyes wide apart; palpi and margin of labrum testaceous. Thorax cribrate-punctate, abdominal segments smooth. Pronotum rounded and very convex; lateral bands rather broad, closely adpressed to disk, slightly produced backwards, anterior margin not reflected; disk not carinate. Supra-anal lamina rounded; posterior margin reflected, punctate. Legs and cerci testaceous.

Total length 15 mm.; pronotum 4·2 × 4 mm.

Nyasaland (*A. Whyte*).

Type in the British Museum.

The blunt convex pronotum makes this an easily recognizable species.

10. *Cyrtotria jallæ*, Giglio-Tos. (Pl. X. fig. 19.)

Stenopilema jallæ, Giglio-Tos, Boll. Mus. Torino, xxii. no. 563, p. 4 (1907).

Upper Zambesi (*Jalla*); Portuguese East Africa (*Swynnerton*); Rhodesia (Deutsche Ent. Nat. Mus.).

Type in the Turin Museum.

The species is distinguished by the strongly reflected anterior margin of the pronotum, which is continuous with the lateral bands, so that these are connected with each other, when viewed from the ventral side. The lateral bands of the pronotum are bent down anteriorly at more than a right angle to the disk.

11. *Cyrtotria scabricollis*, Gerst. (Pl. X. figs. 18, 24.)

Derocalymma (*Cyrtotria*) *scabricollis*, Gerstaecker, Mitt. Ver. Vorpomm. xiv. p. 34 (1883).

Gaboon (*Buchholz*); Cameroons (*Conradt*).

This, the only West-African representative of the genus, can be distinguished by the rugose and tuberculate pronotum with reflected and dentate posterior margin in the male and the dentate lower margin of the lateral bands in the female.

The following is a description of the female:—

Piceous. Head castaneous, finely punctate. Antennæ testaceous at base, remainder castaneous. Pronotum coarsely tuberculate and punctate, anterior margin reflected; lateral bands finely tuberculate, rather broad, anteriorly bent down at more than a right angle to the disk, not closely adpressed to disk, the pronotal channel being wide and shallow, posteriorly produced, their lower border dentate; from the ventral aspect the lateral bands are seen to be in communication with each other anteriorly, as in *C. jallæ*, Gig.-Tos; disk carinate, posterior margin dentate. Meso- and metanotum carinate, punctate, and with a few tubercles. Abdomen very finely punctate.

Total length 16 mm.; pronotum $4{\cdot}9 \times 4$ mm.; pronotum, ♂, $4{\cdot}4 \times 4$ mm.

♂ type in Greifswald Museum; ♀ type in Deutsche Entomologische National Museum.

Genus PLATYSILPHA, nov.

Allied to *Derocalymma*, Burm., but much broader, pronotum about twice broader than long. ♂ with tegmina reduced, quadrate, extending to the middle of the second abdominal tergite, marginal field very broad. Wings rudimentary. Meso- and metanotum only half the breadth of the pronotum, and first abdominal segment narrower than second; subgenital lamina transverse; styles absent. ♀ very like ♀ of *Derocalymma*, but broader and oval.

Type. *Perisphæria murina*, Walk.

The male of this species, when the tegmina are removed, presents the remarkable outline shown in the figure, suggesting that the flattened broad insect has developed from a narrow form such as *Derocalymma porcellio*, Gerst., the mesonotum, metanotum, and first abdominal segment retaining the primitive narrowness. The marginal fields of the tegmina have broadened relatively much more than the discoidal field, and it is these which fill the gap between the posterior margin of the pronotum and second abdominal tergite; the tegmina are capable of only the most restricted movement outwards, and in the living insects are doubtless never moved at all.

In the female, owing to the absence of tegmina, the thoracic and abdominal segments are all equally broad; it is the broadening of the tegmina in the male which appears to have prevented the broadening of the segments that they cover.

Platysilpha murina, Walk. (Pl. X. fig. 20.)

Perisphæria murina, Walker, Cat. Blatt. Brit. Mus. p. 178 (1868).

♂. Fuscous, with fine scale-like pubescence above. Head and antennæ piceous; eyes approximated. Pronotum posteriorly truncate; posterior angles acute, disk cucullate, margins lamellar, anteriorly slightly carinate. Scutellum prominent. Tegmina castaneous, rugose, posteriorly emarginate, radial vein beneath prominent, keeled. Wings shorter than tegmina, infuscated. Eight abdominal tergites visible, first to sixth divided by a transverse suture into a broad anterior portion and a narrow posterior portion; posterior angles of all the tergites produced. Supra-anal lamina quadrate. Cerci very short. Abdomen beneath piceous, nitid; sternites failing to reach lateral margins owing to overlapping of the tergites; subgenital lamina transverse. Legs piceous.

♀. Similar to ♂, but with a rust-red pubescence above; mesonotum, metanotum, and first abdominal segment not coarctate. Subgenital lamina ample.

♂. Length of body 22 mm.; tegmina 7 × 7 mm.; pronotum 7 × 12 mm.

♀. Length of body 27 mm.; pronotum 9 × 18 mm.

E. Africa (British Museum) [type ♀]; Petauke, East Loangwa district, N.E. Rhodesia (Oxford Museum), 3 ♂♂, 4 ♀♀, S. A. Neave Coll.

I have no information as to the habits in life of this species, but I imagine that it, like the allied species of *Derocalymma*, is found under stones. This mode of life in numerous cases induces a flattened form with reduction of the tegmina; the broadening and flattening of the body may be observed, though to a less extent, in such species as *Temnopteryx phalerata*, Sauss., and *Heminauphæta sakalava*, Sauss. & Zehntn.; in these species also the tegmina are reduced and quadrate, and the constriction of the body in the middle has also occurred to a certain extent, and one may assume that it is correlated with the broadening of the reduced tegmina.

EXPLANATION OF THE PLATES.

Plate IX.

Fig. 1. Pronotum of *Protagonista lugubris*, sp. n. × 3.

Fig. 2. Supra-anal lamina of ♂ of *Protagonista borneensis*, sp. n.

Fig. 3. Right tegmen of *Cardax willeyi*, gen. et sp. n. × 10. *r*= radial vein; *u*=ulnar vein; *a.u*=anterior ulnar vein; *p.u*= posterior ulnar vein; *m*=median vein; *a*=anal vein; *ax*= axillary vein; *d*=dividing vein.

Fig. 4. Right wing of ditto.

Fig. 5. Mandible of ditto.

Fig. 6. Maxilla of ditto.

Fig. 7. Tibia (outer aspect) of ditto.

Fig. 8. Apex of abdomen of *Ischnoptera longstaffi*, ♂ (dorsal view).

Fig. 9. Wing of *Anaplecta erythronota*, sp. n.

Fig. 10. Diagrammatic transverse sections through pronota of Blattidæ. A, typical Blattid; B, *Pronaonota*; C, *Pilema*; D, *Bantua*; E, *Derocalymma*. *a*=disk of pronotum; *b*=lateral wings or lateral bands; *c*=typical carinæ; *d*=dorsal carinæ.

Plate X.

Fig. 11. Pronotum of *Cyrtotria macra*, Stål, ♂, dorsal and lateral views. × 4.

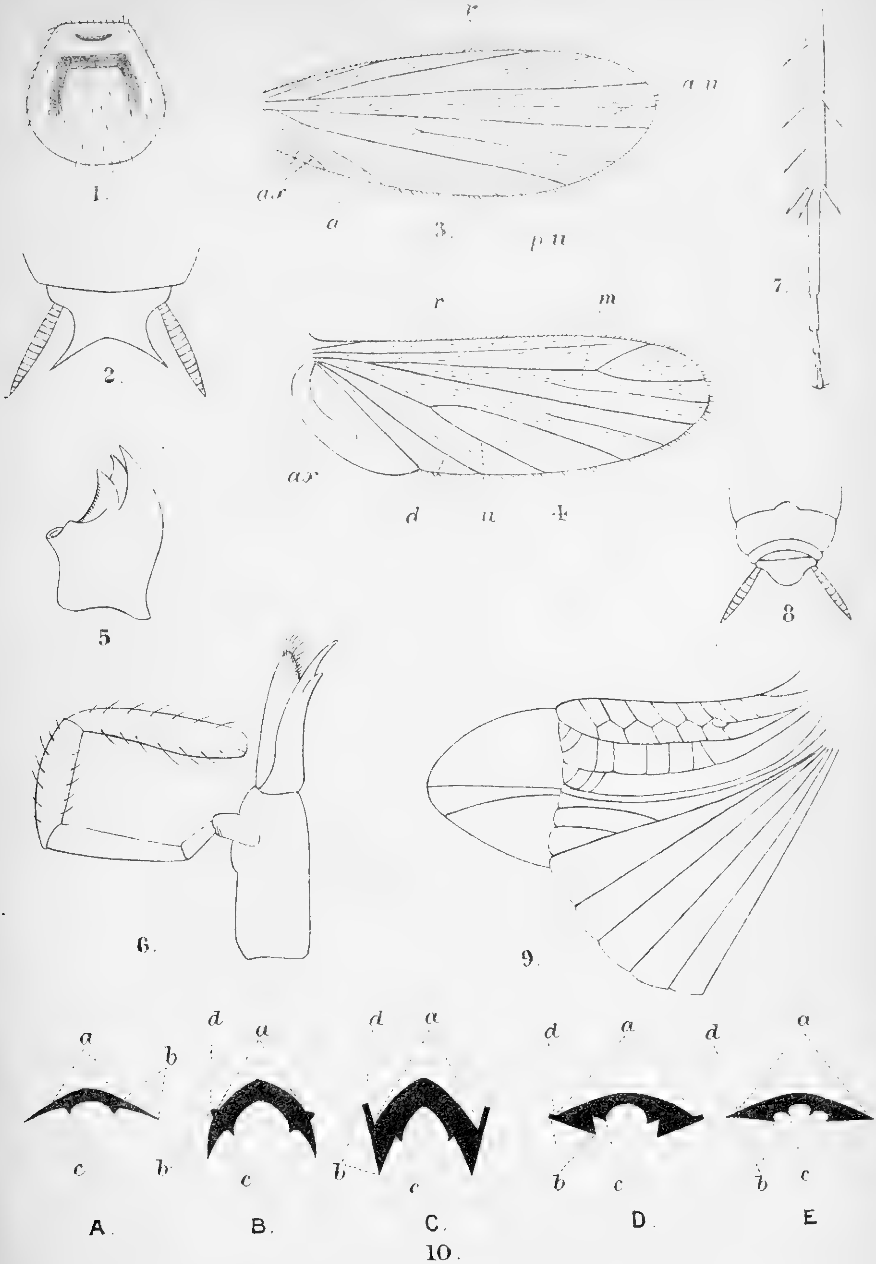
Fig. 12. Pronotum of *Cyrtotria gibbicollis*, Stål, ♀, dorsal and lateral views. × 4.

Fig. 13. Pronotum of *Cyrtotria capucina*, Gerst., ♀, three-quarter, ventral, and lateral views. × 3.

Fig. 14. Pronotum of *Cyrtotria poduriformis*, Wlk., ♀, dorsal and lateral views. × 4.

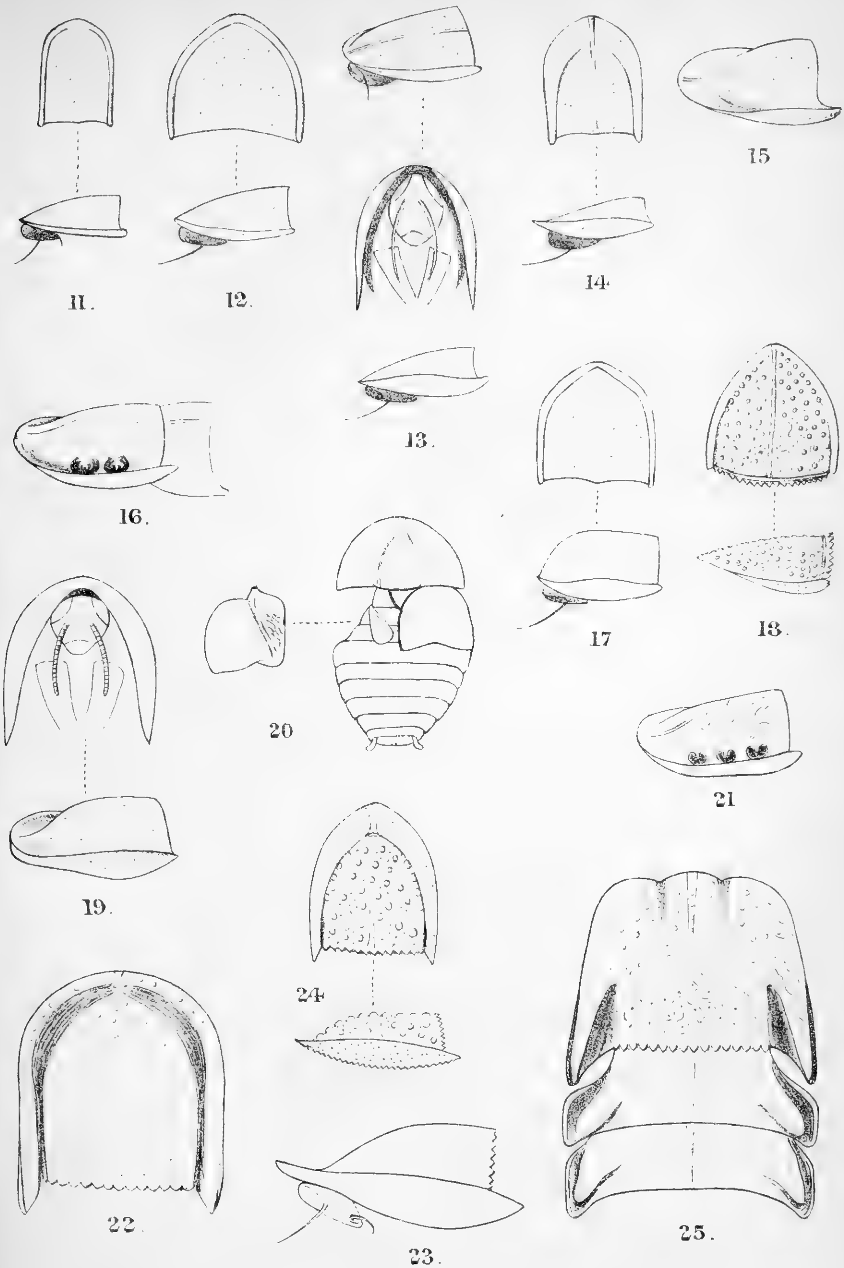
Fig. 15. Pronotum of *Cyrtotria marshalli*, sp. n., ♀, three-quarter view. × 3.

Fig. 16. Pronotum of *Cyrtotria pallicornis*, Kirby, ♀, three-quarter view × 3.



R.S. del.

J. Green lith.



R. S. del.

J. Green lith.

Fig. 17. Pronotum of *Cyrtotria nyasæ*, sp. n., ♀, dorsal and lateral views. × 4.

Fig. 18. Pronotum of *Cyrtotria scabricollis*, Gerst., ♂, dorsal and lateral views. × 4.

Fig. 19. Pronotum of *Cyrtotria jallæ*, Gig.-Tos, ♀, ventral and three-quarter views. × 3.

Fig. 20. *Platysilpha murina*, Walk., ♂, left tegmen removed and shown from beneath. × 1½.

Fig. 21. Pronotum of *Cyrtotria latipennis*, Kirby, ♂, three-quarter view. × 3.

Fig. 22. Pronotum of *Pilema mombasæ*, sp. n., ♀, dorsal view. × 3.

Fig. 23. Ditto, ditto, lateral view. × 3.

Fig. 24. Pronotum of *Cyrtotria scabricollis*, Gerst., ♀, dorsal and lateral views. × 4.

Fig. 25. Thorax of *Bantua ferox*, sp. n., ♀, dorsal view. × 3.

New species of *Blattidae* in the collection of the Deutsche Entomologische National-Museum. (Orthopt.)

By **R. Shelford,** M. A., F. L. S. (Oxford).

(Plate II.)

I am indebted to Mr. Sigm. Schenkling for the opportunity of examining a small collection of *Blattidae* in the Deutsche Entomologische National-Museum. The following species [1]) appear to be undescribed previously.

Genus *Anaplecta* Burm.

Anaplecta conradti sp. n. (Plate II, fig. 1).

♂. Flavo-testaceous, disc of pronotum with two broad longitudinal castaneous vittae, lateral margins broadly hyaline. Tegmina with 10 costals, joined by transverse venulae, discoidal field with 2 longitudinal sectors, which on the right tegmen join distally. Wings infuscated, marginal field dilated, 7 costal veins, radial vein strongly flexuose, median vein slender, straight; medio-discal area twice as broad as medio-ulnar and crossed by one transverse nervule, 1st axillary vein tri-ramose; apical area parabolic, two-fifths of total wing-length, its base not obtusely angled, its apex not emarginate. Antepenultimate and penultimate abdominal tergites narrow and transverse, their posterior margins widely emarginate; supra-anal lamina trigonal, on each side an incrassated carina, these carinae converge posteriorly and define a depression at the bottom of which is situated the scent-gland opening, marked by two tufts of hair. Cerci long, testaceous.

Total length 6,5 mm; length of tegmina 5 mm.

1 ♂, Kamerun (Conradt).

The wing-venation in the African *Anaplectae* is very uniform and affords few characters for purposes of specific diagnosis; the above described species should be readily recognisable by its colouration and by the form of the secondary sexual apparatus of the male, a character which has hitherto not been shown to occur in any other species of the genus.

Genus *Ischnoptera* Burm.

Thanks to the kindness of Professor Dr. G. W. Müller of Greifswald I have been able to examine several of the types of

[1]) Except where otherwise stated the types are in the Deutsche Entomologische National-Museum.

the species described by Gerstaecker in 1883 from the Cameroons district (Mitt. Ver. Vorpomm. XIV) and I find that several of the species referred in that memoir to the genus *Phyllodromia,* belong really to the genus *Ischnoptera*; these are *cinnamomea, basalis, punctifrons, aegrota* and *relucens.* The type of *amplicollis* cannot be found. *Phyllodromia pulchella* Gerst. should be referred to the genus *Theganopteryx* (sub. fam. *Ectobiinae*).

Ischnoptera basalis, Gerst. (Plate II, fig. 2).
Phyllodromia basalis Gerstaecker l. c. p. 63 (1883).

The male exhibits a most remarkable modification of secondary sexual characters, quite unparalleled amongst the other members of the genus or even sub-family. From beneath the posterior angle of the 6^{th} abdominal tergite projects backwardly on either side a narrow lanceolate strip of chitin, terminating in a knob beset with fine setae; these processes extend, as far as the middle of the supra-anal lamina. The 7^{th} tergite is hidden beneath the 6^{th}, the 8^{th} tergite is fringed with hair and conceals the 9^{th} tergite; the supra-anal lamina is strongly produced, exceeding sub-genital lamina, it is depressed at the base, the depression being delimited by three carinae arranged in a triangle, the opening of the scent-glands at the apex of the triangle, a tubercle near the centre of the base-linc. Sub-genital lamina asymmetrical, one style (the left), a deep notch on the right side. Supra-anal lamina of ♀ subtriangular, apex notched.

2 ♂♂, 2 ♀♀, Cameroons (Deutsche Entomol. Nat.-Mus.).

Genus *Phyllodromia* Serv.

Phyllodromia mirabilis sp. n. (Plate II, fig. 3.)

♂ Head testaceous, a castaneous blotch between the eyes; frons flattened, maxillary palpi very slender, testaceous; antennae testaceous at base, remainder fuscous. Pronotum trapezoidal, anteriorly scarcely covering vertex of head, posteriorly obtusely angled, sides deflexed, piceous, lateral margins and a large spot on the posterior part of the disc, fusing with the lateral margins, testaceous. Tegmina considerably exceeding the apex of the abdomen, castaneous at base becoming testaceous at apex, marginal area and a transverse fascia running from margin towards apex of anal field, testaceous; 13 costals, radial vein bifurcate, the lower branch multiramose, the rami reaching the apex of the tegmen, discoidal sectors oblique, anterior ulnar vein multiramose, posterior ulnar simple. Wings testaceous, mediastinal vein triramose at apex, 9—10 costals, ulnar vein 7-ramose, a minute

apical triangle. Abdomen testaceous, tergites and sternites laterally marked with castaneous, 7^{th} and 8^{th} tergites carinate, no opening of scent-glands visible; supra-anal lamina transverse, sub-genital lamina cucullate, apex cleft, margins slightly inflected, styles stout, asymmetrical, sub-triangular, terminating in acute points and overlapping. Cerci elongate, acuminate, hirsute, slender, of 19 joints. Legs testaceous; front femora with a complete row of spines on anterior margin beneath, the spines approximately equal in length; formula of apical spines $\frac{2}{1}$, $\frac{1}{1}$, $\frac{1}{1}$.

♀ Differs from ♂ in its much smaller size, in the shorter tegmina which do not exceed the apex of the abdomen by much; the testaceous spot on the pronotum does not fuse with the lateral margins; tegmina castaneous to apex, a testaceous macula on the margin towards apex; supra-anal lamina cucullate, triangular, sub-genital lamina ample, semi-orbicular; cerci less elongate.

♂ Total length 19 mm; length of body 13,5 mm; length of tegmina 15,8 mm; pronotum 4,1 mm$\times$5,1 mm.

♀ Total length 14 mm; length of body 10,9 mm; length of tegmina 10,7 mm; pronotum 3,9 mm$\times$4,5 mm.

5 ♂♂, 1 ♀, Cameroons (Conradt).

The species is closely allied to *P. supellectilium* Serv. by the coloration of the tegmina, by the flattened frons, venation, form of supra-anal lamina and by the pronounced sexual dimorphism; it can readily be distinguished by the colouration of the pronotum, the larger size, by the absence of scent-gland openings in the male and by the form of the sub-genital lamina and remarkable styles of the male.

Phyllodromia hemerobina, Gerst. (l. c. p. 57. 1883).

The following may be added to Gerstaecker's description of the species: Tegmina with 13 costals, discoidal field reticulated, anterior ulnar multiramose, posterior ulnar simple. Wings with 10—11 costals, the first 6 incrassated, ulnar vein 5-ramose. ♂ with supra-anal lamina trigonal, sub-genital lamina rather large with two symmetrically-placed slender styles. ♀ with supra-anal lamina transverse, sub-genital lamina with the apex cleft. *P. centralis* Gerst. is very similar but the supra-anal lamina of the male is transverse, the species moreover is larger and with the pronotum less heavily marked.

Phyllodromia conrădti sp. n. (Plate II fig. 4.)

♂. Testaceous. Head with frons and face castaneous; antennae testaceous at base, remainder fuscous. Pronotum transversely elliptical, anteriorly and posteriorly truncate, with a

regular castaneous pattern on the disc. Tegmina with the veins and a suffusion in the anal field castaneous, 12 costals, the last two ramose, discoidal area reticulated, sectors oblique, posterior ulnar simple. Wings hyaline, veins castaneous, 13 costals, the first 7 with their apices incrassated and joined by transverse venulae, ulnar 5-ramose, a small triangular apical area, 1st axillary 5-ramose. Abdomen laterally margined with castaneous, it suddenly narrows towards the apex; supra-anal lamina strongly produced, very narrow and pointed; sub-genital lamina produced with a pair of minute styles at the apex. Cerci testaceous, castaneous at the base above, castaneous below. Femora rather sparsely armed, front pair with two spines and a row of piliform setae on the anterior margin beneath, apical spines $\frac{2}{1}$, $\frac{1}{1}$, $\frac{1}{0}$, no genicular spine on front femora. Tibiae spotted with castaneous on the outer aspect.

Total length 10 mm; length of body 7 mm; length of tegmina 8,5 mm; pronotum 2 mm $\times$ 3 mm.

1 ♂, Cameroons (Conradt).

Allied to *P. hemerobina* Gerst. but distinguished by its smaller size and by the form of the supra-anal and sub-genital laminae of the male.

Phyllodromia neutra sp. n. (Plate II fig. 6.)

♂. Testaceous. Head castaneous, antennae testaceous. Pronotum trapezoidal, anteriorly and posteriorly truncate, lateral margins hyaline, disc rufo-castaneous. Tegmina with 12 costals, discoidal area not reticulated, sectors oblique, posterior ulnar simple. Wings hyaline, marginal area suffused with pale rufo-castaneous, apex of mediastinal vein tri-ramose, 8 costals, the last 2-ramose, the first 6 and the mediastinal rami incrassated at the apex and joined by transverse venulae, ulnar vein 6-ramose, a triangular apical area, 1st axillary 4-ramose. Abdomen sullied testaceous, opening of scent-glands on 7th tergite and covered by a brush of fine hairs; supra-anal lamina trigonal; sub-genital lamina with apex cleft in a V-shaped notch, the short styles springing from the apex on either side of the cleft. Cerci moderate, testaceous. Front femora with 5 long spines on anterior margin beneath, succeeded distally by a row of piliform setae, other femora rather sparsely armed, formula of apical spines $\frac{2}{1}$, $\frac{1}{1}$, $\frac{1}{1}$, no genicular spine on front femora.

Total length 10 mm; length of body 6,1 mm; length of tegmina 8 mm; pronotum 2 mm $\times$ 2,5 mm.

1 ♂, Cameroons (Conradt).

Phyllodromia translucida sp. n.

♂. Rufo-testaceous. Pronotum transversely elliptic, posteriorly truncate; lateral margins broadly hyaline. Tegmina hyaline, reticulated, veins white, interstices filled with rufo-testaceous; marginal field broad, 11 costals the last two ramose, discoidal sectors oblique, posterior ulnar vein simple. Wings with veins, apex and marginal field rufo-testaceous; radial vein bifurcate from base, the upper branch giving rise to 4 costals, the lower branch giving rise to 3, the first five costals incrassated at apex, the last three ramose, ulnar vein 5-ramose, a triangular apical area, 1st axillary vein 4-ramose. Supra-anal lamina transverse, very shortly produced; sub-genital lamina with apex deeply and narrowly cleft, a short slender style on either side of the cleft. Cerci moderate, pointed. [Front femora missing.]

Total length 14,5 mm; length of body 12 mm; length of tegmina 12 mm; pronotum 3 mm × 4 mm.

1 ♂, Cameroons (Conradt).

The nearest ally of the species is *P. pustulosa* Gerst. but it differs from that by its larger size and by the absence of castaneous dots from the tegmina.

Phyllodromia erythronotata sp. n.

♀. Closely allied to *P. albovariegata* mihi from Fernando Po, but differs in the following points: — Head entirely rufous. Pronotum rufo-testaceous with broad lateral vittae castaneous, lateral margins hyaline. Tegmina with 10 costals, last two branched. Wings with 9 costals, costal margin not flavid, apical triangle small. Sub-genital lamina at apex carinate, cleft. Cerci castaneous at base.

Total length 9,1 mm; length of body 6,3 mm; length of tegmina 7,3 mm; pronotum 2 mm × 2,1 mm.

1 ♀, Cameroons (Conradt).

It is probable that the males of these two species differ from each other more than do the females and hence I think it advisable for the present to keep the two species separate.

Genus *Liosilpha* Stål.

I have recently had an opportunity of examining the type of *Liosilpha pumicata* Stål and there can be no doubt that the species is not congeneric with *Phyllodromia germanica* L.; it enters more naturally the genus *Pseudectobia* Sauss. as re-defined by me [Ann. Mag. Nat. Hist. (7) XIX p. 36 (1907)]; but I find (1) that *Lupparia* Wlk. antedates *Pseudectobia* Sauss. (2) that *Liosilpha*

may be distinguished from *Lupparia* by the absence of an intercalated apical triangle to the wings. Consequently *Pseudectobia* sinks as a synonym of *Lupparia* which may for the present at any rate be considered as separate from *Liosilpha.* The following species may be referred to *Liosilpha:*

L. pumicata Stål (Brazil). Type of the genus.

L. japonica Shelf. (Japan).

L. alluaudi Shelf. (Madagascar).

L. latipennis Br. (Ceylon) and the species described below.

Lupparia includes *L. adimonialis* Wlk. (Philippines), *L. insularis* Sauss. (Mauritius).

Liosilpha bicolor sp. n. (Plate II fig. 5.)

♀. Flavo-testaceous, nitid, rather convex. Head with eyes rather close together, a castaneous band between them; antennae with basal joint testaceous, remaining joints castaneous shading to rufous. Pronotum trapezoidal, posteriorly very obtusely angled. Tegmina extending slightly beyond apex of abdomen, marginal area very broad, 10 costals, the last 2 or 3 ramose, discoidal sectors oblique, posterior ulnar simple. Wings hyaline suffused with flavo-testaceous, mediastinal vein 3-ramose at apex, 10 costals, ulnar vein 9-ramose, no triangular apical area, 1st axillary 3-ramose. Abdomen castaneous above, paler at base, supra-anal lamina produced triangular, rufous; abdomen beneath castaneous, the sternites posteriorly and laterally margined with testaceous, sub-genital lamina semi-orbicular, not very large, rufous. Cerci of 14 joints, elongate, acuminate, fuscous tipped with testaceous. Femora and coxae testaceous, tibiae and tarsi castaneous; front femora with a complete row of spines on anterior margin beneath, formula of apical spines $\frac{2}{1}$, $\frac{1}{1}$, $\frac{1}{1}$, no genicular spines on front femora.

Total length 17 mm; length of body 14 mm; length of tegmina 14 mm; pronotum 4,9 mm $\times$ 7 mm.

1 ♀, Cameroons (Conradt).

The bicolorous legs and banded abdomen render this a conspicuous species. A male also from the Cameroons is in the collection of Señor Ign. Bolívar, it resembles the female but the supra-anal lamina is strongly produced, slightly exceeding the sub-genital lamina which is asymmetrical and provided with an unequal pair of styles, the right being flattened and short, the left long, strongly chitinised and sharply pointed; the edge of the lamina is grooved to receive these styles.

Genus *Homalosilpha* Stål.

Homalosilpha cruralis sp. n. (Plate II fig. 8c.)

♀. Head piceous, a rufous band between the ocelli, labrum testaceous; antennae rufous. Pronotum discoidal, sides not deflexed, greatest width behind the middle, anteriorly somewhat truncate, posteriorly very obtusely angled; testaceous, a curved irregular vitta on either side of the disc, two spots near the centre of the disc, posterior angles castaneous. Tegmina projecting considerably beyond apex of abdomen, castaneous, the marginal area and apex much paler. Wings flavo-hyaline. Abdomen above and beneath piceous, nitid, supra-anal lamina produced, deeply and triangularly notched at apex. Cerci long, rufous. Legs with coxae and femora piceous, tibiae and tarsi bright rufous; front femora with a row of short spines on the distal half of the anterior margin beneath, no spines on the posterior margin beneath; mid femora with 8 short spines on the anterior margin, 4 long spines on the posterior margin beneath; hind femora with 6 short spines on the anterior margin, 4 long spines on the posterior margin beneath; formula of apical spines $\frac{2}{1}$, $\frac{1}{1}$, $\frac{1}{0}$, no genicular spines on front femora.

Total length 26 mm; length of body 21 mm; length of tegmina 23 mm; pronotum 5,9 mm × 8,1 mm.

British Uganda (Grauer).

The collection also contains a species of *Homalosilpha* from the Cameroons which corresponds exactly with Brunner's description of *Periplaneta vicina* (Nouv. Syst. Blatt. p. 236); the locality of the species was previously unknown.

The genus *Homalosilpha* Stål differs from *Pseudoderopeltis* Kr. in both sexes being fully winged and in the absence of membranous projections from the meso- and metanotum; it differs from *Periplaneta* Burm. in the form of the pronotum which is flat, the sides not being deflexed. Four species are known and they may be discriminated with the help of the following key:

1. Pronotum somewhat hexagonal in outline, its greatest width at the middle. — *ustulata* Burm. (Sunda Islands and Philippines.)

1′. Pronotum not as above, its greatest width behind the middle.

2. Anterior margin of pronotum parabolic.

3. Pronotum piceous, with lateral yellow vittae. — *decorata* Serv. (Borneo.)

3′. Pronotum testaceous with piceous markings on disc. — *vicina* Br. (Cameroons.)

2′. Anterior margin of pronotum sub-truncate. — *cruralis* sp. n. (British Uganda.)

Genus *Periplaneta*, Burm.

Periplaneta funebris sp. n.

♂. Piceous. Frons between the eyes depressed, concave, lower part of face concave and faintly transversely striated; antennae with apical four or five joints flavo-testaceous. Pronotum elliptic, smooth, without impressions, anteriorly truncate, posteriorly obtusely angled. Tegmina extending considerably beyond apex of abdomen. Wings castaneous. Abdomen with lateral flavo-testaceous markings on each sternite except the last two; the tergites project beyond the lateral margins of the sternites and their posterior angles are acutely produced backwards; supra-anal lamina subquadrate, posterior border sinuately emarginate; sub-genital lamina narrow, styles elongate, slender. Cerci moderate, fusiform (the right one has been mutilated and has regenerated). Front femora with a row of strong spines on anterior margin beneath not extending to proximal third, 1 or 2 spines only on posterior margin; formula of apical spines $\frac{2}{2}$, $\frac{1}{1}$, $\frac{1}{1}$. [Posterior tarsi mutilated.]

♀ Similar to ♂ but larger, frons flattened, face convex, very slightly punctate. Tegmina less elongate in proportion to body. Abdominal sternites with lateral castaneous markings. Supra-anal lamina tectiform, deeply notched posteriorly. Posterior metatarsus barely equal to the remaining joints in length, bi-seriately spinose beneath, its pulvillus apical; the next joint with the pulvillus occupying half its length, bi-seriately spinose at base; the next two joints with their pulvilli occupying the total length of the joints.

♂ Total length 29,5 mm; length of body 20 mm; length of tegmina 25 mm; pronotum 6,3 mm; $\times$ 9,1 mm.

♀ Total length 33 mm; length of body 28 mm; length of tegmina 27,5 mm; pronotum 8 mm $\times$ 13 mm.

Cameroons. Type ♂ in Deutsches Ent. Nat. Mus. Type ♀ in Oxford Mus.

The species superficially resembles *P. lata* Herbst but the tarsi are different, being intermediate in character between *Methana* and *Periplaneta*.

Periplaneta bicolor sp. n.

♀ Head and pronotum bright rufous, tegmina and abdomen piceous. Head with eyes rather small and very far apart. Frons

somewhat swollen; antennae and palpi fuscous. Pronotum discoidal, sides deflexed, anteriorly and posteriorly truncate, posteriorly margined with piceous. Tegmina exceeding the apex of the abdomen. Wings with anterior half castaneous. Abdomen beneath with disc castaneous; supra-anal lamina triangularly produced, apex emarginate but not deeply. Cerci long, fusiform. Coxae and tibial spines rufo-castaneous, front femora armed on anterior margin beneath with a complete row of spines, the distal shorter than the proximal, unarmed on posterior margin. Posterior metatarsus longer than remaining joints of tarsus, pulvilli apical.

Total length 22,4 mm; length of body 18,9 mm; length of tegmina 17,1 mm; pronotum 5,8 mm × 7 mm.

1 ♀. Cameroons.

Genus *Nauphoeta* Burm.

Nauphoeta epilamproides sp. n. (Plate II, fig. 7).

♂. Flavo-testaceous. Head with vertex projecting considerably beyond anterior margin of the pronotum. Distance apart of eyes less than length of first antennal joint, a band between the eyes and a narrower band between the antennal sockets, castaneous. The two apical joints of the maxillary palpi castaneous. Antennae fuscous. Pronotum elliptical, its greatest width behind the middle, anteriorly truncate, posteriorly very obtusely angulate, covering the scutellum, uniformly flavid. Tegmina very broad, anterior margin arched, posteriorly rounded, seriately punctate between the veins; marginal area equal to one third of total breadth, mediastinal vein multiramose, radial and anal veins black; the veins of the marginal area beneath are more strongly marked and elevated. Anterior part of wings coriaceous, suffused with rufo-castaneous. Abdomen beneath rufo-testaceous; supra-anal lamina produced, bilobed; sub-genital lamina short, exceeded by the supra-anal lamina, notched on either side to receive the slender styles, the posterior lateral angles acute, spined[1]). Cerci moderate, fusiform. Legs with the coxae and femora rufous, the genicular extremity of the femora, the tibiae and the tarsi castaneous; front femora unarmed beneath, formula of apical spines $\frac{0}{1}$, $\frac{1}{1}$, $\frac{1}{0}$, no genicular spines on front femora.

♀ Similar to ♂ but larger and paler, the tegmina extend more beyond the apex of the abdomen; supra-anal lamina more markedly bilobed; sub-genital lamina ample, its posterior margin sinuate.

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[1]) This is a character common to many species of *Nauphoeta*, but it seems to have escaped notice hitherto.

♂ Total length 48 mm; length of body 44,9 mm; length of tegmina 38 mm; pronotum 11,5 mm × 17,1 mm.

♀ Total length 52 mm; length of body 46 mm; length of tegmina 42,8 mm; pronotum 11,4 mm × 17,5 mm.

Cameroons. Type ♂ in Oxford Museum, Type ♀ in Deutsches Entom. Nat.-Museum.

The species is most closely allied to *N, testacea,* Br. but it can be distinguished by its larger size and broad tegmina with broad marginal field.

Nauphoeta elegans sp. n.

♂. Flavo-testaceous. Head with vertex considerably projecting beyond the anterior margin of pronotum, distance apart of eyes less than length of first antennal joint; a castaneous band between the eyes and some castaneous markings on the face. Antennae piceous, equal to the body in length. Pronotum trapezoidal, posteriorly very obtusely angled, the scutellum exposed; a broad castaneous vitta on either side of the disc, the vittae fail to reach the anterior margin, their inner borders notched. Tegmina considerably exceeding the apex of the abdomen, narrow, their outer margin very slightly sinuate, their apices obliquely rounded; marginal area broad, mediastinal vein multiramose, radial vein piceous for one-third of its length. Wings flavid towards apex of anterior margin. Abdomen castaneous above, with a pair of lateral flavid spots at the base of each tergite; supra-anal lamina quadrately produced, slightly bilobed. Abdomen beneath flavo-testaceous, margined with castaneous; sub-genital lamina as in the preceding species but narrower. Legs with coxae and femora flavo-testaceous, tibiae and tarsi castaneous; formula of apical spines $\frac{0}{1}$, $\frac{0}{1}$, $\frac{1}{1}$, genicular spines small, none on anterior femora.

Cameroons (L. Conradt).

Total length 50 mm; length of body 39,5 mm; length of tegmina 42 mm; pronotum 9 mm × 13 mm.

Allied to *N. flexivitta* Wlk. (= *frenata* Gerst.) but larger, tegmina relatively longer and pronotum differently marked.

Nauphoeta minuta sp. n.

♀. Allied to *N. cinerea* Oliv. but much smaller and differently marked. Testaceous. Head with eyes, widely separated, vertex with four vittae, four spots between the eyes a transverse narrow band between the antennal sockets and a broad longitudinal band extending from between the eyes to the base of the clipeus, casta-

neous. Antennae testaceous. Pronotum as in *N. cinerea* but the central lyrate marking differently arranged and dark castaneous. Tegmina as in *N. cinerea* but just exceeding the apex of the abdomen, radial vein not marked at base. Abdomen above testaceous speckled with castaneous, with lateral blotches of castaneous; supra-anal lamina sub-quadrately produced, posteriorly emarginate; abdomen beneath testaceous with a broad castaneous band on each sternite except the last, where the band is replaced by a round spot; a lateral castaneous blotch on each sternite. Subgenital lamina as in *N. cinerea*. Legs testaceous, formula of apical spines $\frac{0}{1}$, $\frac{1}{1}$, $\frac{1}{0}$.

Total length 15,5 mm; length of body 15 mm; length of tegmina 11 mm; pronotum 5 mm × 6 mm.

1 ♀, Cameroons (L. Conradt).

I have examined a good series of *N. cinerea* from all parts of the world and find that the species is quite constant in the form of markings on the pronotum and in the colouration of the abdomen; the West African form has these markings dark castaneous instead of pale castaneous, but they correspond in shape and arrangement with the markings on the pronotum of forms from other parts of the world. I have therefore little hesitation in separating this small form as a distinct species.

Nauphoeta bicolor n. sp.

♂. Head dark castaneous, nitid, ocelli and palpi testaceous. Eyes further apart than length of 1st antennal joint; antennae fuscous; vertex projecting beyond the anterior margin of the pronotum. Pronotum castaneous, sides deflexed, posteriorly scarcely angulate; two circular impressions on posterior half of disc and a few scattered punctures. Scutellum hidden. Tegmina testaceous scarcely extending beyond apex of abdomen, seriately punctate between the veins, radial veins piceous only at its extreme base. Wings suffused with castaneous. Abdomen castaneous, the disc beneath rufescent; supra-anal lamina quadrately produced, posteriorly emarginate; sub-genital lamina as in the two preceding species. Cerci short, acuminate. Legs castaneous, formula of apical spines $\frac{0}{1}$, $\frac{1}{1}$, $\frac{0}{0}$, genicular spines very small, none on front femora.

♀ Similar, but tegmina not quite reaching apex of abdomen; no impressions on disc of pronotum; supra-anal lamina more deeply emarginate.

♂ Total length 27 mm; length of body 24 mm; length of tegmina 18,8 mm; pronotum 7 mm × 10 mm.

♀ Total length 24,5 mm; length of body 24,5 mm; length of tegmina 18 mm; pronotum 6,7 mm × 9,5 mm.

Cameroons (L. Conradt).

Type ♂ in Deutsches Entom. Nat. Mus., type ♀ in coll. Señor Ign. Bolivar. I know of no species of *Nauphoeta* that at all resembles this; it may readily be distinguished by its striking colouration.

I take this opportunity of describing two new species of *Nauphoeta* in the collection of the Musée d'Histoire Naturelle, Paris.

Nauphoeta pulchra sp. n.

♀ Flavo-testaceous, nitid. Head with a castaneous band between eyes, which are very wide apart; antennae castaneous, two basal joints testaceous. Pronotum trapezoidal, posteriorly truncate, on either side a narrow sinuate black vitta, extending from posterior to anterior margin, on the anterior margin the vittae join each other, posterior margin between the vittae very narrowly black. Tegmina corneous, seriate-punctate, scarcely extending beyond apex of abdomen, radial vein for two-thirds of its length and the anal vein black. Wings flavid. Abdomen uniformly flavid, supra-anal lamina subquadrate, sub-genital lamina ample, posterior margin sub-emarginate at apex. Cerci short, acuminate. Legs flavo-testaceous, tibial spines castaneous.

Total length 31 mm; length of body 29 mm; length of tegmina 24,5 mm; pronotum 8 mm × 10,5 mm.

1 ♀, Lower Ogowé, between Lambaréné and the sea (E. Haug. 1901).

Nauphoeta lurida sp. n.

♀ Piceous. Ocelli testaceous, labrum castaneous. Antennae short; distance apart of eyes equal to 1st antennal joint. Pronotum trapezoidal, posteriorly very obtusely angled, scutellum exposed, sides strongly deflexed, disc punctate with clear interspaces, several shallow impressions, anteriorly, laterally and posteriorly rugosely striate. Tegmina not extending beyond apex of abdomen, flavo-testaceous heavily blotched with piceous along the radial and anal veins. Wings flavo-hyaline. Abdomen uniformly piceous, tergites with a few scattered tubercles, supra-anal lamina sub-quadrate, margins slightly reflected, surface rather rugose. Abdomen beneath nitid, spiracular tubes protruding from beneath angles of penultimate tergite; sub-genital lamina ample, divided by a sulcus, incomplete in the middle, into a narrow anterior zone and a broad posterior zone, surface of latter finely striate and with a few impressions, posterior margin sinuate and slightly

emarginate in the middle. Cerci short, not extending beyond the supra-anal lamina. Legs piceous.

Total length 48 mm; length of tegmina 40 mm; pronotum 10,5 mm × 15,5 mm.

1 ♀, Mpala, Tanganyika.

This is a very remarkable species on account of the rugosity of the pronotum and abdomen and is most nearly allied to *N. thoracica* Kirby.

The following key may assist in the determination of the species of *Nauphoeta*:

(10)	1.	Pronotum with fuscous intra-marginal vittae.	
(9)	2.	Total length exceeding 18 mm.	
(4)	3.	Disc of pronotum with a definite castaneous or fusco-castaneous pattern.	*cinerea* Oliv. (Cosmopolitan.)
(3)	4.	Disc of pronotum unicolorous or with obscure darker suffusions.	
(8)	5.	Intramarginal vittae broad, not joined in front.	
(7)	6.	With marginal yellow vittae.	*flexivitta* Wlk. [*frenata* Gerst. ? = *discoidalis* Sauss.] (Cameroons, Congo.)
(6)	7.	Without marginal yellow vittae.	*elegans* sp. n. (Cameroons.)
(5)	8.	Vittae narrow, joined in front.	*pulchra* sp. n. (Ogowe.)
(2)	9.	Total length not exceeding 18 mm.	*minuta* sp. n. (Cameroons.)
(1)	10.	Pronotum without fuscous intra-marginal vittae.	
(20)	11.	Pronotum testaceous or fulvous.	
(13)	12.	Pronotum with two large confluent spots.	*gestriana* Sauss. (Galla-land.)
(12)	13.	Pronotum not as above.	
(15)	14.	Distance apart of eyes scarcely greater than length of first antennal joint.	*epilamproides* sp. n. (Cameroons, Ogowe.)
(14)	15.	Eyes very wide apart.	
(17)	16.	Marginal area of tegmina very broad, large species	*testacea* Br. = [*pallescens* Kirby] (Cameroons, San Thomé.)
(16)	17.	Marginal area of tegmina not very broad, smaller species.	

(19) 18.	Pronotum finely mottled.	*madecassa* Sauss. (Madagascar.)
(18) 19.	Pronotum not finely mottled.	*heydeniana* Sauss. (Madagascar.)
(11) 20.	Pronotum black or rufous.	
(22) 21.	Pronotum rufous.	*bicolor* sp. n. (Cameroons.)
(21) 22.	Pronotum black.	
(26) 23.	Pronotum narrowly bordered with testaceous.	
(25) 24.	Disc of pronotum unicolorous.	*occidentalis* Fab. (= *rufipes* Kirby). (W. Africa.)
(24) 25.	Disc of pronotum with a testaceous pattern.	*guineensis* Sauss. (Guinea, Gold Coast.)
(23) 26.	Pronotum not bordered with testaceous.	
(28) 27.	Supra-anal lamina carinate.	*thoracica* Kirby (Shiré River.)
(27) 28.	Supra-anal lamina not carinate.	*lurida* sp. n. (Tanganyika.)

Nauphoeta basalis Kirby from Tonkin is a species of *Paranauphoeta* (sub-fam. *Perisphaeriinae*) and *Nauphoeta aspersata* Kirby from the Transvaal is a species of *Oxyhaloa* (sub-fam. *Oxyhaloinae*). *Panchlora brazzae* Bol. appears to be a true *Panchlora* though in colour very similar to *N. flexivitta* Wlk.

Genus *Oxyhaloa* Brunner.

Oxyhaloa perspicua sp. n.

Pronotum and tegmina testaceous, head, body and legs piceous.

♂. Eyes nearer together than antennal sockets; lower part of face depressed, slightly rugose; labrum bordered with testaceous; 13 basal joints of antennae piceous, the remainder rufous. Pronotum trapezoidal anteriorly and posteriorly truncate, with two narrow transverse depressions anteriorly; covered with a sparse erect rufous pubescence. Tegmina lanceolate exceeding the apex of the abdomen, with a sparse erect pubescence, the part of the right tegmen covered by the left, hyaline, with iridescent sheen. Wings hyaline, veins fusco-testaceous, anterior part narrow, lanceolate, its apex not projecting beyond the posterior part, ulnar vein with 13 rami, 1st axillary with 8 rami. Abdomen above castaneous on the lateral margins, supra-anal lamina transverse, narrow, its posterior angles rounded; abdomen beneath opaque piceous, sub-genital lamina slightly produced, with a pair

of slender styles, that are slightly hirsute. Cerci with a testaceous spot at base. Legs piceous. Formula of apical spines $\frac{0}{1}$, $\frac{0}{1}$, $\frac{0}{0}$, no genicular spines on anterior femora; posterior metatarsus shorter than remaining joints.

♀ similar to ♂ but larger; supra-anal lamina more produced, sub-genital lamina ample, margin sinuate.

♂. Total length 18 mm; length of body 14 mm; length of tegmina 13,9 mm; pronotum 4 mm × 4,1 mm.

♀. Total length 23,3 mm; length of body 19,5 mm; length of tegmina 19 mm; pronotum 4,9 mm × 6 mm.

Cameroons.

Type ♂ in Deutsches Ent. Nat.-Mus. Type ♀ in coll. Señor Ign. Bolívar.

Genus *Paraplecta* Shelf.

Paraplecta conradti sp. n. (Plate II, fig. 10).

♂. Dark castaneous. Clipeus testaceous, antennae fuscous, with a testaceous band about the middle. Vertex not covered by pronotum. Pronotum trapezoidal, anteriorly and posteriorly truncate, covered with minute tubercles, disc depressed. Tegmina extending considerably beyond apex of abdomen, 15 costals, 9 discoidal sectors which are longitudinal and given off at an angle from the single ulnar ramus. Wings hyaline, marginal field semi-coriaceous, costals ramose and obsolescent, median vein bifurcate from the base, ulnar vein with 13 rami, all but 4 going towards the dividing vein, axillary veins strongly curved; a prominent apical field, about $^1/_4$ of total wing-length, divided into two unequal portions by a longitudinal vein, the upper portion with obsolescent venation. Abdomen above with the disc testaceous, supra-anal lamina subquadrately produced, slightly emarginate. Cerci rufous. Abdomen beneath with the disc rufous, sub-genital lamina small, the style long and slender. Legs testaceous.

Total length 11,2 mm; length of body 9 mm; length of tegmina 9,1 mm; pronotum 3 mm × 3,1 mm.

Cameroons (L. Conradt).

The species is close to that described by Borg as *Eustegasta parva* and subsequently by me as *Paraplecta aethiopica*, but can be distinguished by the different venation of the tegmina, the granulate pronotum and form of the sub-genital lamina. It is scarcely necessary to point out that neither *parva* Borg nor *conradti* mihi have the slightest affinity with the genus *Eustegasta*.

Genus *Chorisoneura* Brunner.

Chorisoneura pallida, sp. n. (Plate II, fig. 9).

♂. Pale testaceous. Head slightly darker between the eyes, vertex forming a very acute angle with frons. Pronotum transversely elliptical, lateral margins broadly hyaline. Tegmina lanceolate, marginal field broad, mediastinal vein stout, remaining veins very slender, 13 costals, 7 oblique discoidal sectors given off from the anterior ulnar vein, 4 axillary veins. Wings hyaline, marginal field suffused with testaceous, 12 costal veins, all except the last few incrassated, medio-ulnar field extremely narrow, 11—12 transverse venulae crossing the medio-discal area, ulnar vein with 2—3 rami; triangular apical field projecting slightly beyond the outer margin of the wing. Supra-anal lamina triangular, slightly cucullate, carinate; sub-genital lamina produced, cucullate, carinate, a pair of minute styles close together from the apex. Cerci elongate.

♀. Similar, but tegmina with pale flavo-testaceous maculae between the veins; supra-anal lamina less cucullate, apex slightly emarginate, sub-genital lamina very large, posteriorly somewhat truncate.

♂ and ♀ Total length 10 mm; length of body 8 mm; length of tegmina 8,9 mm; pronotum 2 mm × 3 mm.

Cameroons (L. Conradt).

This is easily distinguished from the only other African species *C. africana*, Borg which is pilose on tegmina and legs.

Genus *Pseudoglomeris* Brunner.

Pseudoglomeris oniscina Gerst.

Perisphaeria oniscina Gerstaecker, Mitt. Ver. Vorpomm. XIV p. 75 (1883).

♂. Castaneous. Head completely covered by pronotum; eyes touching, ocelli absent; antennae and maxillary palpi testaceous. Pronotum transversely elliptical, more arcuate anteriorly than posteriorly, anteriorly cucullate, rugose, punctate with a few smooth interspaces, humeral angles pronounced; beneath with the typical carina ending in a spatulate tooth. Tegmina considerably exceeding the body in length, castaneous becoming flavo-hyaline towards their extremities, reticulate, mediastinal field broad. Wings flavo-hyaline. Abdomen rufo-castaneous; sub-genital lamina irregular, asymmetrical, deeply notched on the right side, no styles. Cerci moderate, flavid. Legs rufo-castaneous, tibial spines in three rows.

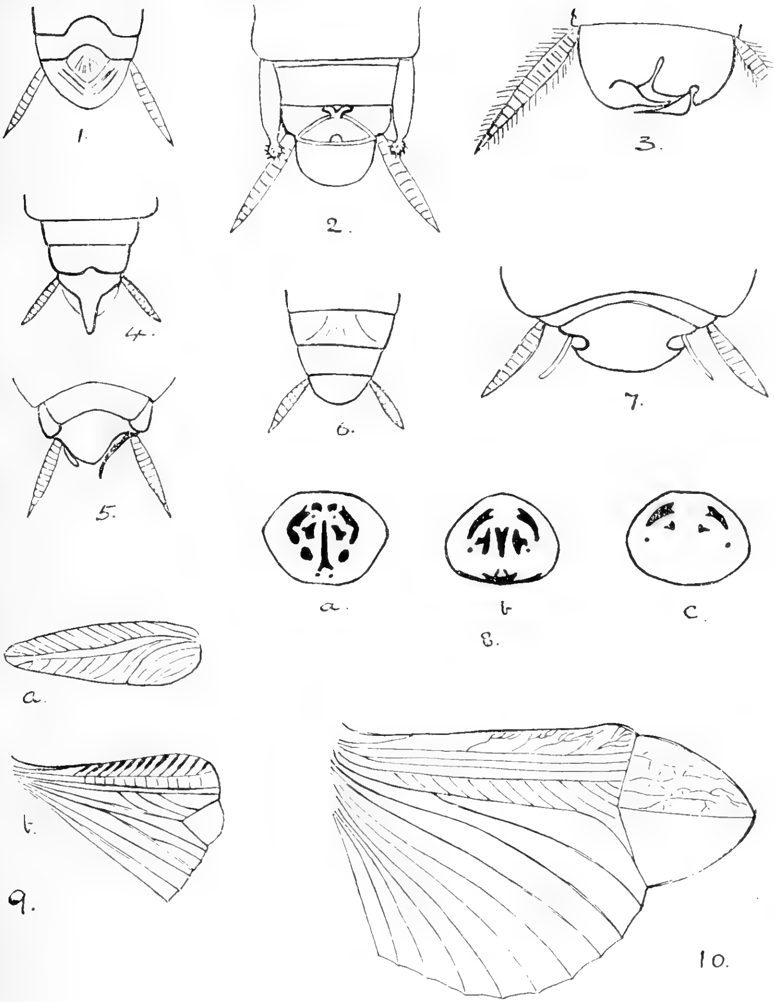
Total length 16,5 mm; length of body 13 mm; length of tegmina 14 mm; pronotum 4 mm × 6,3 mm.

1 ♂, Cameroons (L. Conradt).

I have but little doubt that this is the male of Gerstaecker's species. The typical carina ending in a spatulate tooth is a very characteristic feature of the Oriental genera *Perisphaeria* and *Pseudoglomeris* and the male of *oniscina* is also in general appearance very like males of *Pseudoglomeris* species from Burma, Borneo, Java etc. The female of *oniscina* differs from females of Oriental species of *Perisphaeria* and *Pseudoglomeris* in the total absence of a tooth to the pronotal carinae beneath, but otherwise is very similar; it is convex and possesses the power of rolling itself up into a ball like a Millipede or terrestrial Isopod and like the Oriental *Perisphaeriinae* of the female sex. On account of the division of the abdominal tergites into two zones separated by a sulcus, *oniscina* falls into the genus *Pseudoglomeris* and not into the genus *Perisphaeria*. The genus is new to the Ethiopian fauna.

Explanation of the plate:

Fig. 1. Apex of abdomen of *Anaplecta conradti* sp. n.
♂ Dorsal view.
Fig. 2. „ „ „ „ *Ischnoptera basalis* Gerst.
♂ Dorsal view.
Fig. 3. „ „ „ „ *Phyllodromia mirabilis* sp. n.
♂ Ventral view.
Fig. 4. „ „ „ „ *Phyllodromia conradti* sp. n.
♂ Dorsal view.
Fig. 5. „ „ „ „ *Liosilpha bicolor* sp. n.
♂ Ventral view.
Fig. 6. „ „ „ „ *Phyllodromia neutra* sp. n.
♂ Dorsal view.
Fig. 7. „ „ „ „ *Nauphata epilamproides* sp. n.
♂ Ventral view.
Fig. 8. Pronotum of (*a*) *Homalosilpha ustulata* Burm., (*b*) *H. vicina* Br., (*c*) *H. cruralis* sp. n.
Fig. 9. *Chorisoneura pallida* sp. n. (*a*) tegmen, (*b*) wing.
Fig. 10. Wing of *Paraplecta conradti* sp. n.



New Blattidae by R. Shelford.

[*Reprinted from* 'THE ZOOLOGIST' *for June*, *1907*.]

AQUATIC COCKROACHES.

By R. Shelford, M.A., F.L.S.

In 1897 the writer was collecting insects on a mountain close to Kuching, the capital town of the State of Sarawak, in Borneo, and, whilst examining a small pool at the base of a waterfall for water-beetles, discovered several Cockroaches lurking in the sodden leaves scattered about the edge of the pool. The insects, when disturbed, took to the water, and dived to the bottom, where they hid under sticks and stones. The habit was sufficiently remarkable and unexpected to deserve further investigation, and several specimens were captured alive, and placed in a glass tank with some water and an abundance of vegetable *débris*. All the specimens were immature, and of varying size, ranging from 10 millim. to 25 millim. in length. It was observed that they could not endure total immersion in water for any length of time; if a specimen was confined in a tube full of water, and denied all access to air, it would struggle violently for a few minutes in its efforts to escape, and then sink to the bottom of the tube, and there expire. This is what one might expect from the results of certain experiments conducted by Prof. Plateau, of Ghent, on the relative staying powers of land- and water-insects when totally submerged in water. The distinguished Belgian entomologist found that, whilst terrestrial insects will support an immersion for a period ranging from $97\frac{1}{2}$ hours to $22\frac{1}{4}$ hours, aquatic beetles succumb in periods ranging from $65\frac{1}{2}$ hours to 3 hours. The aquatic Cockroach drowns even more rapidly than aquatic beetles, and it was found that a terrestrial Cockroach, though enduring total immersion for a few hours, is unable to remain alive without air for even the minimum time recorded for terrestrial beetles.

The aquatic Cockroaches that were kept under observation were very inactive, resting for hours at a time on the dead leaves with which they were provided; generally the front part of the

body was in the water, but the tip of the abdomen was never submerged, even when all the rest of the body was covered. The abdomen moved up and down with a rhythmic action, and bubbles of air issued at more or less regular intervals from the prothoracic spiracles. These air-bubbles were seen to form gradually, to grow larger and larger, and finally to break away from the spiracles; about twenty per minute passed through the spiracles. Air issued from the mesothoracic spiracles only when the insect was violently agitated. From these observations it seemed fairly obvious that the terminal abdominal spiracles were inspiratory in function, the thoracic spiracles expiratory, and that it was necessary, therefore, for the insect to have the tip of the abdomen exposed to the air, but that it was a matter of indifference whether the expiratory spiracles were above water or below it. In order to settle the question beyond all manner of doubt, some specimens were fastened with cotton threads to strips of cork; half the number were fastened head downwards, the other half head upwards. The cork-strips with the attached insects were then immersed in tubes of water. In the case of the reversed specimens the water covered the thorax and basal segments of the abdomen, but the tip of the abdomen projected above the water-level; the other specimens had the abdomen in the water, but the thorax exposed. The results in every case proved the inspiratory and expiratory functions of the abdominal and thoracic spiracles respectively. The reversed specimens endured their constrained position for many hours (twenty-four to forty-eight or more), and when released seemed little the worse for their experience. On the other hand, the specimens with the abdomen immersed in water died in less than twelve hours, sometimes in less than six. The structure of the thoracic spiracles in Cockroaches is quite different from that of the abdominal spiracles,* and a difference in function is only to be expected; nevertheless, when repeating these experiments with terrestrial Cockroaches, such as *Panesthia javanica,* I was unable to demonstrate satisfactorily the functional differences of their spiracles. This failure may be accounted for—in part, at any rate—by the fact that this species struggled long and violently when pinioned to the cork-strips, and, as they are extremely muscular insects,

* Miall and Denny, 'The Cockroach,' 1886, pp. 151–155, ff. 85–88.

their bonds had to be tightly fastened in order to keep them in position ; even then the prisoners did not relax their efforts to free themselves, and I believe that they died of exhaustion and of injuries sustained in their struggles rather than from drowning. The aquatic species, on the other hand, remained comparatively quiet ; the reversed specimens, being fastened in a position more or less natural to them, and being able to obtain their supply of air in quite a normal and usual manner, were very little dis-

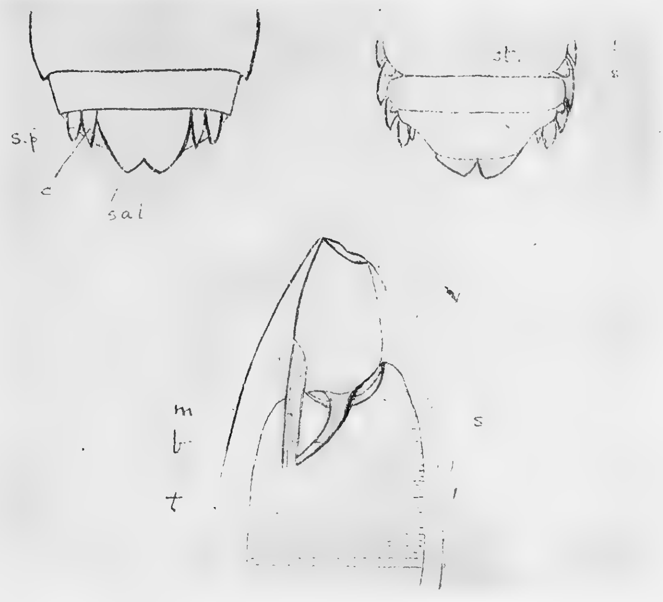


FIG. 1.—End of abdomen of a larva of *Rhicnoda natatrix*, sp. n., dorsal view ; *s.p.* spiracular tube ; *c.* cercus ; *s. a. l.* last dorsal tergite.

FIG. 2.—The same, ventral view ; *st.* abdominal sternite ; *s.* spiracle ; *t.* abdominal tergite.

FIG. 3. — Spiracular tube, highly magnified, seen in optical section ; *v.* vestibule ; *s.* spiracle ; *m.* muscle working *b.*, the chitinous bow ; *t.* trachea.

tressed by their bonds, and the other specimens were soon reduced to a comatose condition by the difficulty of obtaining air. The terminal spiracles of these aquatic Cockroaches are situated at the base of two tubes visible on the dorsal side projecting from below the seventh tergite, and external to the anal cerci (fig. 1).

This same feature may be observed in many terrestrial *Blattidæ*, so that it cannot be regarded as associated with the aquatic habit. A microscopic examination of one of these spiracular tubes reveals the following features (fig. 3). The orifice of the tube leads into a short vestibule (*v.*), the vestibule joins a large trachea (*t.*), but intervening between vestibule and trachea is the spiracle (*s.*), a narrow slit in a diaphragm; the slit is opened and closed by the action of a chitinous bow (*b.*), worked by a muscle (*m.*) attached to the wall of the vestibule. This is essentially the structure of all the abdominal spiracles in Cockroaches, and the terminal spiracular tubes of the aquatic species are merely enlarged equivalents, shifted dorsally, of the short spiracular plates of the preceding segments (fig. 2, *s.*), which are situated on the *ventral* side of the abdomen.

Externally, at any rate, the aquatic Cockroaches exhibit no particular modifications for their remarkable habit of life, the legs are not different from those of allied terrestrial genera, and there is nothing in their general appearance to suggest their aquatic habit of life. During the experiments that have been described one distinctive feature, however, in the economy of the insects was notable, *viz.* the ease with which they could remain below the surface of the water. Most adult aquatic insects, e. g. *Dytiscus*, *Corixa*, *Notonecta*, can only keep below the surface by continuing to swim, or by propping themselves under some stone or submerged leaf; directly they relax their efforts they float to the surface. Again, if a large heavy Cockroach, such as *Panesthia javanica*, is thrown into water, it flounders helplessly on the surface, and is quite unable to sink; whereas the much lighter aquatic Cockroach is able to swim, to dive, and to remain submerged with great ease. An explanation of these facts is found if the tracheal systems of the insects are examined. The tracheæ of *Dytiscus* and of *Panesthia* present the usual appearance of opaque silvery tubes filled with air; the tracheæ of the aquatic Cockroaches, on the other hand, are transparent, flattened, strap-like structures, dilated here and there only with air-bubbles. *Dytiscus* and *Panesthia* are buoyed up in water by the plentiful supply of air stored in their bodies, but the tracheæ of the water Cockroach are mere air-passages, not storehouses; the respiratory movements are rapid, causing a constant circulation of air, and

if the supply is entirely cut off there is practically no reserve supply contained in the body to draw upon. Hence the rapid death of the insect when totally submerged; if only partially submerged death supervenes less rapidly, probably because some air can be drawn through the thoracic spiracles. *Panesthia javanica* is able to endure *total* immersion longer than the *partial* immersion to which individuals were submitted, because these individuals, when bound, struggled so violently as to make heavy demands on their reserve air-supply; their position was so constrained, so unusual, and so unnatural that they were not able to "take matters quietly," even when fastened in a position presumably favourable to drawing in a fresh supply. Plateau has shown that aquatic insects drown more quickly than terrestrial insects, and suggests that this is because their supply of oxygen is quickly converted into CO_2 through their violent struggles to escape, whereas terrestrial insects, when submerged in water, soon cease to struggle, and, although they become comatose, they recover power of movement when restored to land. It would be of interest to learn if an aquatic insect such as *Dytiscus* would endure partial immersion, *i. e.* with the tip of the abdomen exposed, as well as the aquatic Blattids.

Dr. Nelson Annandale discovered some aquatic Cockroaches in the Malay Peninsula*; the females were wingless, and rested on floating logs, whence they dived into the water when disturbed; the males were winged, and were seen to rise from the surface of the water, but were never seen to enter it. Dr. Annandale states, moreover, that the egg-cases of this species were found in crevices of the floating logs. If the Malay Peninsula species belongs to the same subfamily of *Blattidæ* as the Bornean species, namely, to the *Epilamprinæ*, this discovery of egg-cases is of some interest, for the *Epilamprinæ* are, so far as is known, viviparous insects, the chitinous ootheca deposited by the females of other subfamilies being represented by a delicate membrane enveloping the eggs inside the brood-sac of the mother. Unfortunately, Dr. Annandale's specimens appear to be lost, so that they cannot be identified with certainty.

Another species has been discovered in Formosa,† and Dr.

* Ent. Rec. 1900, p. 76.

† Shiraki, Ann. Zoolog. Japon. vi. 1906, p. 32, pl. 2, f. 4.

Annandale has found an immature specimen in Chota Nagpur, India.* It remains only to give a name to the Bornean species, which appears to be undescribed. The following description is drawn up from an unique female specimen in the Hope Museum, Oxford, evidently the adult of some of the larval forms obtained. The male is unknown.† The Japanese species has been wrongly referred to the genus *Opisthoplatia*; there is no doubt that it is congeneric with the Bornean species.

Subfam. EPILAMPRINÆ.

Genus RHICNODA, Brunner.

Rhicnoda natatrix, sp. n.

♀. Castaneous. Allied to *R. rugosa*, Br., from Burma and Java, but larger, and with the dorsal segments less rugose. Head concavely depressed between the antennal sockets, this area cribrately punctate, rest of head with scattered punctures. Pronotum just covering vertex of head, arcuate, posterior margin truncate, anterior and lateral margins slightly reflected; a few scattered punctures and a pair of impressions on the disc. Tegmina rufous, exceeding the mesonotum in length. Meso- and metanotum and abdominal tergites slightly and irregularly rugose, the posterior margins of the sixth and seventh tergites plicated. Supra-anal lamina produced, apex emarginate, cerci abbreviated, spiracular tubes short; subgenital lamina ample, posterior margin sinuate, disc transversely wrinkled. Front femora with five spines in middle of anterior margin beneath, four spines on posterior margin; formula of apical spines $\frac{2}{1}, \frac{1}{1}, \frac{1}{1}$, front femora with no genicular spine. Posterior metatarsus equals remaining joints. Total length, 35·5 mm.; length of tegmina, 7 mm.; pronotum, 10 mm. × 17·5 mm.

Borneo (Wilson Saunders collection, Hope Museum, Oxford).

* Jour. As. Soc. Bengal (new series), vol. ii. 1906, pp. 105, 106. Dr. Annandale confirms my account of the respiration of these insects, and noted the ease with which his specimen was drowned when totally submerged.

† In a preliminary account of these Cockroaches (Rep. Brit. Assoc. 1901, p. 689) I stated that they consisted of two species—one an Epilamprine, the other a Panesthiine. This is an error due to inaccurate information supplied to me at a time when my knowledge of the *Blattidæ* was less than it is now. All the specimens collected by me are immature, and are referable to two Epilamprine genera, *Rhicnoda* and *Epilampra*. The females of the former genus apparently lead a semi-aquatic life always. I expect that it will be found eventually that some terrestrial species of *Epilampra* are amphibious or aquatic in their earlier stages.

XII. *Studies of the* Tetriginæ (Orthoptera) *in the Oxford University Museum.* By J. L. Hancock, M.D., F.E.S. (Chicago).

[Read 28th March, 1907.]

Plate XXI.

The following notes and descriptions relating to Orthoptera are based on the collection of *Tetriginæ* contained in the Hope Department of Zoology, University Museum, Oxford, England. The writer is indebted to Mr. R. Shelford, who generously supplied for determination the present collection. Besides this material, the writer has drawn upon some examples of these insects in his own collection, which have not hitherto been recorded.

This article forms a sequel to various published contributions by the writer bearing on the *Tetriginæ*, the last of which appeared in " Genera Insectorum."*

Section TRIPETALOCERÆ, Bolivar.

Genus Tripetalocera, Westwood.

1. *T. ferruginea*, Westwood, Zool. Journ., vol. v, p 444, Pl. xxii, f. 3.

One male example from Kuching, N.W. Borneo, Dyak coll., R. Shelford; Oxford Museum.

Section DISCOTETTIGIÆ, Hancock.

Genus Discotettix, Costa.

1. *D. belzebuth*, Serville, Hist. Nat. Ins. Orthoptera, p. 759, 1839.

Five examples from Kuching, N.W. Borneo, Dyak. coll., R. Shelford. One of these, an immature specimen, presented by the Sarawak Museum; Oxford Museum.

* Genera Insectorum, 48me Fascicule, Orthoptera, Fam. *Acridiidæ*, Subfam. *Tetriginæ*, 4 Plates (P. Wytsman), pp. 79, 1906.

2. *D. shelfordi*, sp. nov.

Cinereous or fuscous, body rugose, conspersed with coarse granulations; superior ocelli placed between the middle of the eyes. Antennæ inserted little below and anterior to the ventro-anterior margin of the eyes, not at all serrulate, from the sixth to the eighth articles moderately compresso-dilated, the sixth only a little so modified, the ninth oval, the two apical articles very small, the apex of last joint acute. Frontal costa distinctly protuberant between the antennæ, and advanced much further than the eyes. Pronotum truncate anteriorly, the two prozonal carinæ behind the anterior margin parallel, dorsum rugose-subnodulose, strongly flattened, presenting sulcations anteriorly: humeral angles little produced laterally, behind the shoulders subfossulate, and subgibbose, with a pair of gibbose tubercles posteriorly about midway between the humeral angles and base of process; the course of median carina serrulate, indistinctly and irregularly subtuberculose; lateral marginal carinæ often bearing a number of small shining, somewhat obtuse tubercles, each humeral angle presenting one at the apices; pronotal process rather stout, little depressed, lengthily extended beyond the apex of posterior femora; lateral lobes little laminate outwards, the posterior angle excavato-truncate and angulate subacute, not at all serrulate or spinose. Elytra moderately large, distinctly acuminate towards the apices; wings fully explicate, as long as the process. Femora elongate, margins minutely serrulate; anterior femora above somewhat subbilobate; middle femora above subtrilobate, the posterior tibiæ serrulate, but not at all spinose. Length of male and female, entire, 17·5–19 mm.; pronotum 16–18·5 mm.; posterior femora 6–8·5 mm.

Three examples from Kuching, N.W. Borneo, Dyak coll., R. Shelford; Oxford Museum.

A very distinct species resembling, perhaps, *D. scabridus*, Stål, more than any other member of the genus.*

Genus Phæstus, Bolivar.

1. *P. insularis*, sp. nov.

Stature small, cinereo-fuscus. Body somewhat smoothly granulate. Head not at all exserted; vertex narrowed forward, nearly equal in front to one of the eyes, anteriorly subtruncate, transversely lightly carinate, advanced about as far as the anterior fourth of the eyes,

* Named in honour of Mr. R. Shelford, whose interest in the Oxford Museum is shown by the large series of Orthopteran specimens bearing his name as the donor.

fossulate on each side of the feeble, abbreviated, median carina; frontal costa strongly protuberant between the antennæ and rather narrowly sulcate; superior ocelli placed between the submedian part of the eyes, visible in profile; antennæ inserted little anterior to and scarcely below the ventro anterior margin of the eyes, filiform, but the fifth and sixth articles little compresso-expanded, the seventh to ninth distinctly compresso-dilated, the two apical articles minute, the apices acute. Pronotum anteriorly little rounded produced, posteriorly acuminate, extended little beyond the apices of the posterior femora; anterior prozonal carinæ behind the anterior margin wanting, median carina little acute, percurrent, in profile substraight; anterior sulci subobsolete, humeral angles wanting, the humero-apical carinæ percurrent backward, and forward extended as far as the point opposite and above the inferior sinus; lateral lobes turned down, the posterior angles obtuse. Elytra small elongate, sub-lanceolate; wings fully explicate, extended to or little beyond the apex of pronotal process. Anterior and middle femora elongate, the margins straight, entire; the posterior femora little incrassate, the superior margin arcuate, minutely serrulate, posterior tibiæ pluri-spinose and minutely serrulate, the inner fourth part toward the apices unarmed, the three pulvilli of the first article of posterior tarsi equal in length, subacute. Length of body, female entire, 9·5–10 mm.; posterior femora 5–5·5 mm.

Three examples from Kuching, N.W. Borneo; two of these from the Sarawak Museum, No. 337 and 357, and the other Dyak coll., R. Shelford; Oxford Museum.

The antennæ in this species are more compressed than in *P. mellerborgi*, Stål, and the facial frontal costa is more narrowly sulcate.

Section CLADONOTÆ, Bolivar.

Genus DELTONOTUS, Hancock.

1. *D. tectiformus*, Hancock, Spolia Zeylanica, vol. ii, p. 111–112, Pl. I, figs. 2–2*a*, 1904.

Two examples from Pundaluoya, Ceylon; Oxford Museum.

These specimens have the pronotum less produced anteriorly than the type examples in the author's collection, from the same locality, and are provisionally considered immature. It is however possible that they are

distinct from *tectiformus*, and two in my collection from Hantane, Ceylon, bear the label "*D. cristatus*, sp. nov.," awaiting study of a larger series to settle the matter.

Genus POTUA, Bolivar.

1. *P. coronata*, Bolivar, Ann. Soc. Ent. Belg., vol. xxxi, p. 208, Pl. I, fig. 9, 1887.

Four examples from Kuching, N.W. Borneo, R. Shelford; Oxford Museum.

Genus EPITETTIX, nov.

Stature small, body somewhat smooth but densely punctate. Vertex broad, little narrowed forward, much wider than one of the eyes, anteriorly not at all transversely carinate but on each side with a very small, though distinct elongate longitudinal carina, front margin convex, with an abbreviated somewhat thickened and produced median carina ; face oblique ; superior ocelli placed between the lower third of the eyes; the face together with the crown of head forming an obtuse angulate profile, frontal scutellum not divided above the posterior ocelli, triangular, and the margins but little elevated, not produced in profile ; antennæ inserted little forward and below the ventro-anterior margins of the eyes, the distance between them much wider than that to the eyes. Pronotum anteriorly truncate, posteriorly cuneate, with subacute apex, not extended backward to the apices of the posterior femora ; median carina percurrent, distinct, and substraight, dorsum subtectiform, punctate, prozonal carinæ behind the anterior border somewhat indistinct ; humeral angles almost wanting ; lateral lobes little reflexed outwards, the posterior angles obliquely truncate behind. Elytra and wings wanting ; margins of anterior and middle femora entire, posterior femora little incrassate and of ordinary form, the margins of posterior tibiæ plurispinose, and minutely serrulate, the first articles of the posterior tarsi strongly larger than the third, the three pulvilli about equal in length. Resembling *Diotarus*, Stål.* Type, *Epitettix punctatus*.

1. *E. punctatus*, sp. nov. (Plate XXI, fig. 1.)

Fuscous, with the posterior half of dorsum and upper distal half of hind femora flavo-ferruginous, the anterior and middle tibiæ

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* This genus may be assigned to my Subsection II, under *Cladonotæ*, and next to *Diotarus*, Stål, as given in my key in Genera Insectorum. Vide p. 9, 10, 48me Fasc. Orthop. Subfam. *Tetriginæ*, 1906.

light, annulate with fuscous. Apical articles of maxillary palpi little dilated, oval. Length of body entire, male, 10 mm.; pronotum 7 mm.; posterior femora 5 mm.

One example from Kuching, N. Borneo, R. Shelford; Oxford Museum.

Genus CLADORAMUS, nov.

This genus differs from *Pantelia,* which it most resembles, in the anterior margin of pronotum being profoundly produced forward over the head, forming a process, in the sulcation of the forward dorsal margin of crest, the presence of strongly carinate-crenulate humeral angles which are little produced outwards, and in the lateral lobes of pronotum bearing a superior or elytral sinus for the reception of the elytra, the latter being of ordinary form.

1. *C. crenulatus*, sp. nov. (Plate XXI, fig. 2.)

Greyish, body strongly rugose, somewhat sparingly provided with small subspiniform tubercles. Face nearly vertical, viewed in profile wholly denticulate; vertex very broad, on each side forward adjoining the eyes armed with an obliquely produced spine, the middle backward denticulate, and forward strongly armed with produced denticles between the eyes; frontal scutellum with convex sides, the margins denticulate produced, the facial median carina below as well as face on each side denticulate; eyes small and subsessile; the three apical articles of the maxillary palpi compresso-dilated; antennæ inserted far below the eyes, the distance between them and that to the eyes nearly equal. Pronotum rugose, strongly tectiform and cristate, anteriorly profoundly produced beyond the head, in the form of a sublongitudinal process, posteriorly extended only little beyond the apices of the posterior femora; the anterior process viewed from above presenting a strongly spinose margin below on each side, the apex bifid and the upper dorsal margin distinctly sulcate; viewed in profile the whole dorsal crest little elevated somewhat horizontally, but the anterior half undulato-crenulate, the process anteriorly little arcuate above, at the middle behind the shoulders somewhat angulate; from here backwards strongly sinuato-dentate, the apex very little turned downward behind; humeral angles strongly carinate, little produced outwards, and strongly crenulate; lateral lobes of pronotum posteriorly bisinuate, below widely laminate outwards subhorizontally, arcuate anteriorly, posteriorly often armed with three obtuse denticles or crenulate. Elytra

of moderate size, elongate sublanceolate, where they rest at the sides, the inferior lateral margin of pronotum little arcuato-excavate for their reception; wings wanting. Anterior femora strongly compresso-foliate, scarcely longer than wide, the superior margin sinuate, below coarsely crenulate; anterior tibiæ strongly compresso-ampliate behind the middle, above canaliculate, with a spur midway on the margins, behind the inner margin toward the distal extremity armed with acute spines (about five), middle femora externally tuberculose, margin above strongly acute-sinuate and denticulate, below lobato-crenulate, middle tibiæ ampliate at the middle, the superior inner margin furnished with denticulate lobes; hind femora externally strongly rugose and armed with spinous tubercles, the outer carina below, as viewed from above bearing strongly denticulate lobes at the middle, and at the apical fourth similarly armed, though not so pronounced, knees denticulate on the sides and above, the lower margin of hind femora strongly lobato-denticulate, the posterior tibiæ rather stout, the canthi crenulate and plurispinose, the inner canthus regularly spined, the third pulvilli of the posterior tarsi little longer than the first or second articles, straight below. Length of the body entire, female, 11 mm.; pronotum 12·8 mm.; anterior process of pronotum 2·5 mm.; posterior femora 5·5 mm.

One female example from Rhodesia, East Loangwa, Africa, S. A. Neave; Oxford Museum.

Section SCELIMENÆ, Bolivar.

Genus SCELIMENA, Serville.

1. *S. producta*, Serville, Hist. Nat. Ins. Orthopt., p. 762, 1837.

One example from East, and three from West Java, H. Fruhstorfer; Oxford Museum.

2. *S. sanguinolenta* (Krauss), Bolivar, Ann. Soc. Ent. Belg. xxxi, p. 216–217, 1887.

One example from East, and three from West Java; Oxford Museum.

3. *S. logani*, Hancock, Spolia Zeylanica, vol. ii, p. 120–122, figs. 5–5*c*, Pl. I, 1904.

Two examples from Kelawaewa, N.C. Province, Ceylon; Oxford Museum.

4. *S. gavialis*, Saussure, Ann. Soc. Ent. France, p. 485, 1860.

Three examples. One from Pundoluoya, and two from Kandy, Ceylon; Oxford Museum.

5. *S. india*, sp. nov.

Resembling *S. producta* but slightly stouter in stature. Body fuscous, pale variegated, the carinæ of dorsum flavo-maculate, the tibiæ with pale annuli. Vertex subequal in width to one of the eyes, the frontal carinæ on each side little compressed and subacute. Pronotum anteriorly somewhat subangulate, posteriorly extended beyond the knees of the hind femora about as far as the tibial apices, but not so lengthily attenuate as in *producta;* dorsum conspersed with granules; depressed and uneven, between the sulci forwards subfossulate on each side, between the shoulders bearing subelevated longitudinal costate protuberances, humeral angles unarmed, behind the shoulders bifossulate, and presenting a pair of rounded subelevated nodules, again another pair somewhat fused together appear posteriorly opposite the middle of the hind femora which are indistinct; posterior process stout at the base and acuminate toward the apex; median carina rather incrassate, unevenly undulate, anteriorly at the margin little protuberant and subtuberculate: lateral lobes at the anterior margin armed with small tubercles, the posterior margin little laminate outwards, and armed with a distinct, acute spine on each side, directed transversely but little curved forward. The posterior femoral margins entire, the posterior tibiæ armed with minute denticles, the margins dilated towards the apices; the first article of the posterior tarsi dilated but not so widely as in *producta.* Length of body entire, male, 19·5 mm.; pronotum 18 mm.; posterior femora 7 mm.

Two examples from Cherrapunji, Assam; Oxford Museum.

Genus CHTHONOTETTIX, Hancock.*

1. *C. palpatus*, Stål, Ofv. Vet. Akad. Forh., p. 57, 1877. = *Chthonius palpatus*, Bolivar. (Plate XXI, fig. 3.)

Body sparingly granulose, fuscous, obscurely variegated with flavous. Vertex distinctly narrower than one of the eyes, the anterior carinæ rounded oblique; eyes globose; frontal costa roundly protuberant between the antennæ, narrowly sulcate and divided little above the posterior ocelli, the latter situated between the lower third of the eyes, conspicuous in profile; antennæ inserted scarcely

* The name *Chthonotettix* was proposed by the present author (*vide* Genera Insectorum, 48me Fasc. Orthoptera, Subfam. *Tetriginæ*, p. 26, 1906) to replace Bolivar's preoccupied genus *Chthonius.*

below and anterior to the ventro-anterior border of the eyes. Pronotum truncate anteriorly, posteriorly lengthily extended beyond the knees of the hind femora; median carina often interrupted, disappearing anteriorly behind the frontal margin and posteriorly on the apical process, in profile little gibbulous between the shoulders, posteriorly sinuate; dorsum depressed, with abbreviate costa between the humeral angles, strongly fossulate behind the humeral angles, subnodulose in single order posteriorly, and the process toward the extremity smooth and cylindrical; lateral lobes little laminate, the posterior angles armed with distinct transverse spine on each side, acute. Elytra moderately large, elongate sublanceolate; wings fully explicate but not quite reaching to the pronotal apex. Femoral margins entire, anterior and middle femora very slender, nearly equal in length; margins of posterior tibiæ moderately dilated, sparingly armed with small denticles, the inner canthus unarmed at the distal fourth; the first articles of the posterior tarsi not at all dilated, the three pulvilli equal in length and straight below. Length of body entire, female, 22 mm.; pronotum 20·5 mm.; posterior femora 8·5 mm.

One example, No. 2772, from Luzon, Manilla, Philippines, E. L. Meyer; Oxford Museum.

Genus Gavialidium, Saussure.

1. *G. crocodilus*, Saussure, Ann. Soc. Ent. France, p. 481, 1860.

Four examples from Pundaluoya, Ceylon. Oxford Museum.

Genus Oxynotus, Hancock.

1. *O. hastatus*, Hancock, Occas. Mem. Chicago Ent. Soc., vol. i, No. 1, p. 12, 13, Pl. I, figs. 3–3*a*, 1900.

One example from N.E. Madagascar, Bay of Antongil, Mocquerys; Oxford Museum.

Genus Criotettix, Bolivar.

C. tricarinatus, Bolivar, Ann. Soc. Ent. Belg. xxxi, p. 224, 1887.

Eleven examples from Pundaluoya, and other points in Ceylon; Oxford Museum.

2. *C. flavopictus*, Bolivar, Ann. Soc. Ent. France, vol. lxx, p. 582, 1902.

Two examples from Cherrapunji, Assam; Oxford Museum.

3. *C. oculatus magnus*, var. nov.

This form nearly resembles the Sumatran species *oculatus*, Bolivar, but differs in being larger in stature.

Length of body entire, male and female, 15–18 mm.; pronotum 14–17·5 mm.; posterior femora 5·5–7 mm.

Five examples from West and Mid Java; Oxford Museum; numerous examples in the author's collection.

Genus ACANTHALOBUS, Hancock.

1. *A. rugosus*, Bolivar, Ann. Soc. Ent. Belg. xxxi, p. 228, 1887.

Five examples are referable to this species, they are from Kuching, N.W. Borneo, R. Shelford; Oxford Museum.

2. *A. saginatus*, Bolivar, Ann. Soc. Ent. Belg. xxxi, p. 225, 1887.

Seven examples, including specimens from Java and China; Oxford Museum.

3. *A. longinotus*, sp. nov.

This species is closely allied to *A. rugosus*, Bolivar, and might possibly be the long-winged form of the latter. It differs principally in the pronotum being strongly extended backward beyond the femoral apices, and in the body being somewhat stouter. It bears moreover a near resemblance to *nexuosus* also, but it is smaller in stature. Ferruginous or tending to fuscous. Vertex wider than one of the eyes, very little narrowed forward, very slightly marginate on each side anterior to the lateral supraocular lobes, median carina abbreviated; frontal costa very sparingly compresso-elevated between the antennæ, in profile scarcely sinuate below the median ocellus, above declivous. Pronotum anteriorly truncate, posteriorly lengthily extended beyond the femoral knees; dorsum convex between the shoulders, subbifossulate behind them, the surface rugose, irregularly furnished with abbreviated rugæ and tubercles, posterior angle of the lateral lobes triangular, somewhat acute, but not spinose. Wings little longer than pronotum in the female. Anterior and middle femora margins subentire, the posterior femoral margins minutely serrulate. Length of body entire, male and female, 16·5–19 mm.; pronotom 16–17·5 mm.; posterior femora 6·5–7·6 mm.

Seven examples from N.W. Borneo, R. Shelford; Oxford Museum.

4. *A. fuscus*, sp. nov. (or var. ?).

Similar in stature to *longinotus*, but entirely fuscous (as in *nexuosus*), the vertex wide, and the frontal costa more roundly produced between the antennæ, and sinuate below the median ocellus, the lateral margin of vertex with distinct lobes and marginate on each side forward. Dorsum of pronotum very strongly rugose, plentifully furnished with abbreviated rugæ, and tubercles irregularly disposed; in profile the median carina of pronotum strongly sinuate, little subnodulose forward, and distinctly depressed behind the shoulders; lateral lobes little more reflexed outwards, the triangular posterior angle little more acute and somewhat spinose. Length of body entire, female, 18 mm.; pronotum 16·8 mm.; posterior femora 8 mm.

One example from N.W. Borneo, R. Shelford; Oxford Museum.

5. *A. miliarius*, Bolivar, Ann. Soc. Ent. Belg. xxxi, p. 226, 1887.

Two examples from Pundaluoya, Ceylon; Oxford Museum.

6. *A. miliarius cuneatus*, Hancock, Spolia Zeylanica ii, part vii, p. 133, 1904.

Three examples from Ceylon; Oxford Museum.

7. *A. robustus*, sp. nov.

A stouter form than either *longinotus* or *rugosus*, and like the latter having abbreviated wings and pronotal process not at all or very little extended beyond the knees of the hind femora; dorsum between the shoulders rather broader; colour ferrugineous or fuscous; the vertex distinctly wider than one of the eyes; lateral lobes of pronotum decidedly reflexed outwards, the posterior angles triangular but not at all spinose; dorsum of pronotum strongly rugose and tuberculose; the third articles of the posterior tarsi (in the female) little longer than the first or the second. Length of body entire, male and female, 13·8–15·4 mm.; pronotum 13–14 mm.; posterior femora 7–9 mm.

Two examples from Kuching, N.W. Borneo. One of these from the Sarawak Museum, the other from R. Shelford; Oxford Museum.

8. *A. bispinosus*, Dalman, Vet. Akad. Hand., p. 77, 1818.

One example from Penang, Malacca, E. L. Meyer; Oxford Museum, No. 3452.

Genus Loxilobus, Hancock.

1. *L. assamus*, sp. nov.

A small form, with abbreviated wings and pronotal process. Cinereous or ferruginous, often infuscate on the sides and legs; vertex subequal in width to one of the eyes, advanced as far as the eyes, narrowed forward, distinctly longitudinally sulcate on each side; frontal costa in profile convex. Pronotum anteriorly truncate, posteriorly cuneate, extended backward as far as the hind femoral knees; dorsum tuberculose, subcostate between the shoulders, and here somewhat convex, deplanate posteriorly; median carina of pronotum sinuate in profile, sometimes little elevated forward, before the shoulders; lateral lobes little laminate outwards and subtriangular, obliquely truncate; margins of anterior and middle femora entire, the third articles of the posterior tarsi, with the third pulvilli longest, the apices of the first and second acute. Elytra elongate, with rounded apices; wings abbreviated, little shorter than the pronotal process.

Three examples from Cherrapunji, Assam; Oxford Museum.

2. *L. truncatus*, sp. nov.

Resembling *acutus*, but having the lateral lobes of pronotum little dilated, and obliquely truncate behind, the posterior angles distinct, but not acute, the dorsum of pronotum lightly rugose, but without distinct lineate rugæ or tubercles; wings fully explicate and extended backward as far as the pronotal process. Length of body entire, female, 14 mm.; pronotum 13 mm.; posterior femora 6·2 mm.

One example from Kuching, N.W. Borneo, Dyak coll., R. Shelford; Oxford Museum.

3. *L. insidiosus*, Bolivar, Ann. Soc. Ent. Belg. xxxi, p. 228, 1887. (*Criotettix insidiosus* of Bolivar.)

One example from Kuching, N.W. Borneo, R. Shelford; Oxford Museum.

Genus Bolotettix, nov.

Body conspersed with granules or somewhat punctate. Vertex strongly narrower than one of the eyes, subacuminate forward and little ascendant, subsulcate on each side of the feeble median carina, the lateral margins anteriorly provided with suboblique carinæ open in front, and bear small indistinct supraocular lobes; frontal costa in profile little compresso-elevated between the antennæ, viewed in

front narrowly compressed and sulcate little above the posterior ocelli, the rami below moderately divergent toward the median ocellus; eyes large and strongly globose, somewhat prominently elevated; posterior ocelli placed near the lower third of the eyes; palpi with the apical articles little compresso-dilated; antennæ filiform and very slender, inserted scarcely below the antero-ventral border of the eyes. Pronotum anteriorly truncate, posteriorly subulate, often extended little beyond the hind femoral apices; dorsum anteriorly cylindrical, the prozonal and lateral carinæ before the shoulders wanting; between the shoulders backward deplanate, and behind the shoulders often subbifossulate; median carina forward behind the anterior margin wanting, in front of the shoulders somewhat compresso-arcuate; lateral lobes of pronotum posteriorly bisinuate, the posterior angles moderately laminate, and on each side strongly armed with a transversely produced spine, or rarely little produced. Elytra very small and lanceolate; wings fully explicate, not extended so far as the apex of pronotal process or about as far. Anterior and middle femora narrow, elongate, carinæ entire, posterior femoral margins serrulate, the genicular denticles moderately distinct, posterior tibiæ scarcely at all ampliate toward the apices, with the canthi compressed, spinose, and minutely serrulate, the first and third articles of the posterior tarsi subequal or the first little longest. Type *Bolotettix validispinus.*

This genus is readily distinguished from *Criotettix,* which it most resembles, in the very narrow subacuminate vertex, the absence of the anterior prozonal and lateral carinæ on the dorsum of pronotum, the cylindrical character of the forward part of the pronotum, the strongly-produced spines arming the posterior angles of the lateral lobes, the very small elytra, and the insertion of the antennæ barely below the eyes.

1. *B. validispinus,* sp. nov. (Plate XXI, fig. 5.)

Dark ferruginous, the face and legs lighter, the lateral thoracic spines and borders of pronotum rufescent, posterior femora externally below longitudinally striated with fuscous, posterior tibiæ and under parts of body fuscous. Face oblique; vertex ascendant forward, in front reduced to nearly one-half the width of one of the prominent and globose eyes, anteriorly subobliquely marginate on each side, in profile not at all produced, middle feebly carinate, very little longitudinally sulcate on each side, supraocular lobes indistinct; frontal costa little compresso-elevated between the antennæ. Pronotum anteriorly cylindrical, subulate posteriorly, little concave backwards, and extended beyond the knees of the hind femora and

slightly beyond the wings, the apical process little upturned at the tip, dorsum of pronotum nearly smooth, conspersed with granules, little bifossulate behind the shoulders; median carina in profile undulate, before the shoulders compresso-arcuate, and forward behind the anterior margin obliterated, but distinct posteriorly; lateral carinæ of pronotum wanting: the lateral margins of pronotum just above the elytra at sides longitudinally sulcate; lateral lobes with the posterior angles strongly produced outward on each side in a transverse acute spine, stout, and triangular. Elytra small and lanceolate; wings largely concealed by the pronotum posteriorly. Anterior and middle femora rather slender, the margins entire; the apical denticles of posterior knees subacute, the ante-genicular denticles moderately distinct; the first articles of the posterior tarsi having the first pulvilli smallest and acute, the third barely longer than the second, subflattened below. Length of body entire, female, 15 mm.; pronotum 14·5 mm.; posterior femora 7 mm.

One example from (Kuching?) N.W. Borneo; Sarawak Museum, No. 344; Oxford Museum.

2. *B. planus*, sp. nov.

Greyish fuscous, the face similarly coloured, but the legs lighter, the posterior femora externally light above, striated with fuscous below, posterior tibiæ fuscous. Vertex very narrow, in front barely more than half the width of one of the globose eyes, ascendant forward; frontal costa barely compresso-elevated between the antennæ, face oblique, scarcely sinuate. Pronotum anteriorly cylindrical, the prozonal carinæ very indistinctly indicated, posteriorly subulate and extended little beyond the knees of the hind femora; the dorsum interspersed with coarse granulations, subpunctate posteriorly, between the shoulders bearing indistinct, abbreviated, secondary costa; median carina subincrassate, but low, obliterated behind the anterior border, posteriorly straight, but little compresso-arcuate forward before the shoulders; lateral lobes with the posterior angles on each side bearing a transverse spine, strongly narrowed acute. Elytra small, lanceolate, and black; wings fully explicate but extended only as far backward as apex of pronotal process, coloured black or fuscous. Anterior and middle femora elongate, narrow, margins entire; posterior femora externally bearing strongly expressed oblique costæ; the first and second pulvilli of posterior tarsi equal in length, acute, the third longer and flattened below. Length of body entire, female, 12 mm.; pronotum 11 mm.; posterior femora 5·7 mm.

One example from Mt. Matang, 3000 feet, near Kuching, N.W. Borneo; Sarawak Museum, No. 342; Oxford Museum.

This species is readily distinguished from *validispinus*, by the smaller stature, being narrower between the shoulders, in the more coarsely granulate pronotum, the more slender thoracic spines, the less extended and straighter pronotum, and the black elytra and wings.

3. *B. perminutus*, Bolivar, Ann., Soc. Ent. Belg. xxxi, p. 227, 228, 1887.

This species occurs in the Philippines, and was described by Bolivar under the caption *Criotettix*. It was inadvertently omitted from my list of the species of *Criotettix* in my article in Genera Insectorum (48me Fasc. Orthoptera, Subfam. *Tetriginæ*, p. 28, 1906), but it is referred to there in a foot-note. Attention was called to the species as belonging to a new subgenus. I find it falls naturally under the new genus *Bolotettix* above described.

4. It is quite likely that *Criotettix nigellus* (Bolivar, Ann. Soc. Ent. Belg., p. 225, xxxi, 1887) belongs here also. It is from Gaboon (Bolivar).

Genus Ocytettix, nov.

Recalling *Charagotettix*, to which it bears a near resemblance. Body strongly rugose ; vertex wide, transverse, imperfectly carinate forward, on each side bearing a small compresso-acute carina, inwardly interrupted, fossulate on each side of the small median carina ; eyes small ; face moderately oblique, strongly sinuate ; frontal costa roundly compresso-produced between the antennæ, viewed in front sulcate little above the posterior ocelli, below the rami moderately subparallel to the median ocellus ; posterior ocelli placed between the lower third of the eyes ; antennæ inserted distinctly before the eyes ; maxillary palpi little compresso-ampliate apically. Pronotum anteriorly truncate, middle of the anterior margin often excavate, posteriorly acuminate, the apex spinose, often upturned and not extended backward beyond the knees of the hind femora ; dorsum strongly depressed, often unigibbose forward and transversely fossulate between the shoulders, backwards often quadrinodulose ; the humeral angles produced outwards laterally and strongly carinate, the lateral margins just before and behind the shoulders strongly elevated ; the lateral carinæ profoundly compresso-sinuate ; median carina strongly compresso-gibbose in front of the shoulders, depressed and indistinct behind the anterior margin, anterior prozonal carinæ strongly expressed, fossulate between them, lateral scapular area at the sides wide ; lateral lobes at

the interior border often bearing a tubercle on each side, the posteror angles widely laminate, produced outwards and triangular acute, obliquely truncate behind. Elytra and wings wanting. Anterior femora elongate, lobate ; posterior femora above externally bearing a series of large subrounded tubercles, and at the middle bituberculate, margins serrulate, the genicular and antegenicular denticles stout, subtriangular, posterior tibæ little ampliate towards the apices, the canthi plurispinose and minutely serrulate.

1. *O. latihumerus*, sp. nov. (Plate XXI, fig. 4.)

Body obscure ferruginous, infuscated, legs fuscous and pale annulate. Pronotum dilated between the humeral angles, the dorsum having the anterior gibbosity distinctly elevated, convex forward and declivous backward, posteriorly provided with two pairs of low subacute nodules; the posterior angles of the lateral lobes having the margin behind the thoracic spines somewhat serrulate. Anterior femoral margins above subbilobate, with a median denticle below; the posterior femora having the first denticle situated at the middle of the external pagina little produced, the second smaller. Length of body entire, female, 12·5 ; pronotum 10 mm. ; posterior femora 7 mm.

One example from N.E. Madagascar, Bay of Antongil, Mocquerys ; Oxford Museum.

Section METRODORÆ, Bolivar.

Genus SYSTOLEDERUS, Bolivar.

1. *S. greeni*, Bolivar, Ann. Soc. Ent. France, vol. lxx, p. 584, 1901.

Six examples from Pundaluoya, Ceylon; Oxford Museum.

2. *S. parvus*, sp. nov.

A small species, smoothly granulate ; cinero-ferruginous, with black wings. Head little exserted; eyes globose and strongly approximate: vertex narrowly accuminate; frontal costa between the eyes vertically declivous, not at all sinuate; antennæ inserted distinctly before the eyes; posterior ocelli placed on a plane with the antero-ventral border of the eyes. Pronotum smoothly granulate, anteriorly truncate, cylindrical forward, and behind the anterior margin slightly ascendant, posteriorly subulate; median carina of pronotum very thin, low, and indistinct; the posterior angles of the lateral lobes turned down, subobtuse. Elytra light, elongate, margins above substraight, below curvate, acuminate forward and

apically, the external surface very lightly punctate; wings fully explicate. Legs light ferruginous, margins of anterior and middle femora little compressed, entire. Length of the body entire, female, 11 mm.; pronotum 10·2 mm.

One example from Kuching, N.W. Borneo; Sarawak Museum, No. 358; Oxford Museum.

Genus RHYNCHOTETTIX, nov.

Body smoothly punctate; face profoundly retreating; vertex strongly rostrate, viewed from above the rostrum very much longer than the length of one of the narrow eyes, the apex distinctly rounded, the middle longitudinally carinate; frontal costa very narrowly sulcate, the carina above compressed, percurrent forward underneath the process to the apex; eyes viewed from above narrowly subelliptical, in profile compresso-conoidal; superior ocelli placed on a plane with the lower third of the eyes; the median ocellus placed far below the eyes; antennæ inserted little before (below) the antero-ventral border of the eyes. Pronotum truncate anteriorly, the margin little convex produced, posteriorly acuminate, but not spinose, toward the apex little concave and extended backward little beyond the posterior femoral knees; dorsum narrow between the shoulders, cylindrical forward, the prozonal carinæ here obliterated; median carina low deplanate forward, but little elevated and distinct posteriorly; lateral carinæ low; lateral lobes with the anterior margin below obliquely excised, the posterior angles of the lateral lobes little laminate outwards, distinctly produced in an acute spine on each side. Elytra and wings wanting. Middle femora elongate, margins little compressed entire; genicular and antegenicular denticles moderately stout; the posterior tibiæ little ampliate toward the apices, the canthi spinose, the first article of the posterior tarsi distinctly longer than the third. Type *Rhynchotettix rostratus.**

1. *R. rostratus*, sp. nov. (Plate XXI, fig. 7.)

Fusco-ferrugineous, with lighter longitudinal striation on each side of dorsum, posterior femora with the external faces below striated with fuscous. Rostrum triquetrous, strongly produced and when viewed from above about one and a half times longer than the length of one of the narrow eyes, the base of process subequal in width to one of the eyes; frontal costa viewed in profile roundly excavate opposite the eyes, and below very slightly sinuate, between

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* This genus belongs to the second subsection under *Metrodoræ*, as given in my article *Tetriginæ*, Genera Insectorum, p. 32, 1906.

the antennæ very slightly compresso-elevated. Pronotum with the dorsum finely punctate, frontal margin rounded-truncate, posteriorly acuminate, the apical process extended little beyond the knees of the hind femora, and little longitudinally concave; posterior angles of the lateral lobes armed on each side with an acutely-produced spine, obliquely truncate behind; the pulvilli of the posterior tarsi distinctly flattened below, the first smallest, the second and third equal in length, and longer than the first. Length of body entire, female, 14·8 mm.; pronotum 11·8 mm.; posterior femora 6 mm.

One example from N.E. Madagascar, Bay of Antongil, Mocquerys; Oxford Museum.

Genus MITRITETTIX, Hancock.*

1. *M. processus*, sp. nov. (Plate XXI, fig. 8.)

Stature little larger than *phyllocera*, which it nearest resembles. Body finely punctate, granulate; grayish ferruginous. Vertex rostrate, flattened above, subnarrowed forward, horizontally produced, about twice the length of one of the eyes, and at the base nearly twice the width of one of the eyes; viewed from above the first half of the process with the sides subparallel, at the middle of the rostral margins angularly excavate on each side; the apical half of process being little narrower than the first half, and little dilated at about the middle, forward the sides converge forming an obtuse angle in front, middle carinate, slightly longitudinally sulcate on each side; head viewed in profile little convex above, the rostrum often little bent downward, face oblique; frontal costa somewhat widely sulcate, dividing above the posterior ocelli, the carina above passing forward on the underside of the rostrum strongly compresso-elevated; posterior ocelli placed between the submiddle part of the eyes, a little in advance of them; median ocellus situated far below the eyes; maxillary palpi with the apical articles dilated; antennæ short, inserted scarcely below the antero-ventral border of the eyes; maxillary palpi with the apical articles dilated. Pronotum anteriorly truncate, little angulate produced at the middle of the front margin, posteriorly strongly acuminately produced beyond the knees of the hind femora, the process stout; dorsum deplanate, smoothly punctate, sometimes slightly rugulose, narrow between the shoulders; prozonal carinæ parallel, humeral angles widely obtuse; median carina compressed, elevated before the shoulders subtectiform,

* The name *Mitritettix* was proposed by the writer for Bolivar's *Mitraria*, the latter name being preoccupied. Vide article in Genera Insectorum, 48me Fasc., p. 51, 1906.

depressed between the shoulders and distinct behind the shoulders backward ; lateral carinæ indistinct, granulate ; lateral margins just above the elytra sulcate ; lateral lobes of pronotum little reflexed outwards, slightly laminato-rectangulate. Elytra small, elongate, rather narrow, subacuminate towards the apices ; wings fully explicate, not quite reaching to the apex of the pronotal process. Femoral margins minutely serrulate, anterior femora compressed, the superior carina distinctly compresso-arcuate ; middle femoral margins little compressed, in the male distinctly ampliate toward the base ; hind femora narrow elongate, the genicular and antegenicular denticles rather stout, acute ; posterior tibiæ with the canthi minutely serrulate, plurispinose, and scarcely at all ampliate toward the apices ; the first and third articles of the posterior tarsi equal in length, the three pulvilli equal in length, somewhat flattened below. Length of body entire, male and female, 19–21·5 mm. ; pronotum 16–19 mm. ; posterior femora 6·8–7·5 mm.

Four examples from Kuching, N.W. Borneo. One from the Sarawak Museum, No. 340, the others from R. Shelford ; Oxford Museum.

Genus TETTICERUS, Hancock.

1. *T. bigibbosus*, Hancock, Occasional Mem. Chicago Ent. Soc., vol. i, No. 1, p. 5, Pl. I, figs. 1–1*b*, 1900.

Four examples from N.E. Madagascar, Bay of Antongil, Mocquerys ; Oxford Museum.

Genus CRYPTOTETTIX, Hancock.

1. *C. spinilobus*, Hancock, Occasional Mem. Chicago Ent. Soc., vol. i, No. 1, p. 14, 15, Pl. I, figs. 6–6*b*, 1900.

Two examples from N.E. Madagascar, Bay of Antongil, Mocquerys ; Oxford Museum.

Genus MAZARREDIA, Bolivar.

1. *M. insularis*, Bolivar, Ann. Soc. Ent. Belg. xxxi, p. 240, 1887.

Four examples from Pundaluoya, Ceylon ; Oxford Museum.

2. *M. centrosa*, Bolivar, Ann. Soc. Ent. Belg. xxxi, p. 242, 1887.

Two examples from Kuching, N.W. Borneo, Sarawak Museum, Nos. 352 and 355 ; Oxford Museum.

3. *M. planitarsus*, sp. nov.

Resembling *sculpta*; stature rather slender; grayish fuscous; head not at all exserted; vertex flattened, slightly wider than one of the eyes, little narrowed forward, on either side with oblique carina, the middle carina obscure, indistinctly sloping forward; frontal costa viewed in profile compresso-protuberant between the antennæ, the face strongly sinuate below; eyes globose, sessile, not higher than the dorsum. Pronotum gibbose forward, rather narrow between the shoulders, very strongly produced backwards equal to the length of the hind femora beyond the femoral apices; median carina elevated gibbose between the shoulders, abruptly declivous posteriorly and behind the shoulders depressed, posteriorly straight; dorsum behind the prozonal carinæ forward at the sulci constricted, humeral angles widely obtuse, bicarinate; lateral carinæ on process posteriorly serrulate; anterior prozonal carinæ distinctly expressed, rather short and little divergent backward; dorsum on each side bearing an abbreviated costa scarcely in front of the shoulders, and a pair of lineate tubercles or protuberances above the middle of the posterior femora; lateral lobes little reflexed outwards, produced angulate. Elytra moderately large, oval, little narrowed toward the apices, externally strongly punctate; wings fully explicate, extended backward as far as the pronotal apex. Anterior and middle femora elongate, the margins little compressed undulate, the superior carina of the anterior femora noticeably compressed; the canthi of posterior tibiæ minutely spinose and serrulate; the first articles of the posterior tarsi very slender, longer than the third, the pulvilli strongly deplanate below and almost obliterated, the apical pulvillus very small acute. Length of body entire, male and female, 14·8–16·5 mm.; pronotum 14–15·5 mm.; posterior femora 5–5·8 mm.

Four examples from Kuching, N.W. Borneo. One of these specimens from Sarawak Museum, No. 347, the others from R. Shelford; Oxford Museum.

Genus Xistra, Bolivar.

1. *X. stylata*, sp. nov.

Ferruginous. Head compresso-elevated, in profile sinuate. Vertex cornute, strongly concavely depressed forward, on each side the oblique carinula strongly elevated and formed into an acute, vertically-produced, cylindrical spine, which curves a little forward, extended above the eyes, equal to about four-fifths the height of one of the eyes; eyes elevated and conico-rotundate, substylate; posterior ocelli placed barely below the eyes; antennæ inserted far below the

eyes; the frontal costa rather widely sulcate, evenly divergent forward to the median ocellus, little compresso-elevated between the antennæ. Pronotum granulate, posteriorly lengthily subulate, extended beyond the hind femoral apices; dorsum little ascendant near the anterior margin, between the shoulders elevated, compresso-cristate, the top of crest subdentate, before and behind the crest the median carina often little compresso-dentate; median carina low forward just behind the anterior margin and posteriorly on the process; humeral angles widely obtuse, the lateral carinæ continuous forward on the shoulders; the anterior prozonal carinæ parallel; posterior angles of the lateral lobes subangulate, slightly reflexed, subrounded-truncate. Elytra elongate, apices narrowly rounded, externally punctate, fuscous with light apices; wings fully explicate, barely extended beyond the pronotal apex; anterior and middle femora elongate, the carinæ distinctly compressed, undulate, the superior carinæ of the middle femora produced in an apical spine; posterior femora elongate, genicular spine acute, little produced; the three pulvilli of the first tarsal articles equal in length. Length of the body entire, female, 16·2 mm.; pronotum 15 mm.; posterior femora 5·9 mm.

One example from Putlam, Ceylon, in the Oxford Museum.

This species is nearly allied to *Xystra corniculata*, Stål.

Genus Notocerus, Hancock.

1. *N. cornutus*, Hancock, Occasional Mem. Chicago Ent. Soc., vol. i, No. 1, p. 5, 6, figs. 2, 2*a*, 1900.

Three examples from N.E. Madagascar, Mocquerys; Oxford Museum.

1a. *Var.*

Similar to *cornutus*, but of smaller stature, the male and female measuring as follows: entire length 16–16·5 mm.; pronotum 14–15·4 mm.; posterior femora 6–7 mm. In the male the wings extend beyond the pronotal apex, and in this sex the pronotum between the elevated humeral angles is transversely convex and little tumose; the median carina here being low, but in the female little compressed, otherwise similar to *cornutus*.

Two examples from the same locality as the preceding.

Genus Hybotettix, Hancock.

1. *H. humeralis*, Hancock, Occasional Mem. Chicago Ent. Soc., vol. i, No. 1, p. 9, 10, fig. 4, Pl. I, 1900.

One female example which measures as follows: entire length 18 mm.; pronotum 17 mm.; posterior femora 8 mm. From N.E Madagascar, Bay of Antongil, Mocquerys; Oxford Museum.

Genus CAMELOTETTIX, nov

Resembling *Notocerus* and *Hybotettix*, but differing in the vertex bearing more perceptibly compresso-marginate carinæ laterally before the supraocular lobes, and distinctly fossulate on each side of the feeble median carina; the frontal costa but very little compresso-elevated between the antennæ, the rami evenly divergent forward tc the median ocellus; the eyes in profile globose instead of ovoid; the pronotum at the shoulders slightly dilated, in profile the lateral carinated margins widely arcuato-elevated above the articulation of the hind femora, the dorsum smoothly deplanate, but transversely plurifossulate; the lateral lobes of pronotum with the elytral sinus nearly as pronounced as the inferior one below. Type *Camelotettix curvinotus.*

1. *C. curvinotus,* sp. nov. (Plate XXI, fig. 6.)

Grayish-ferruginous; body smoothly granulate, quadrate in section or in front view; vertex transverse, but not transversely carinate, flattened, anteriorly convex, nearly twice the width of one of the eyes, laterally compresso-marginate forward of the supraocular lobes, strongly fossulate on each side of the feeble median carina; eyes sessile, not higher than the dorsum; posterior ocelli placed between the submiddle plane of the eyes; antennæ inserted barely before the ventro-anterior border of the eyes; apical articles of maxillary palpi little dilated. Pronotum anteriorly truncate, the dorsal front margin somewhat roundly excavate, posteriorly acuminate, extended backward beyond the knees of the hind femora, the shoulders widely rounded, carinate, and viewed in profile strongly arcuately elevated; dorsum transversely trifossulate, sloping backward; the median carina strongly sinuate; before the shoulders bearing an abbreviated parallel costa on each side; prozonal carinæ granulate, little convergent backward; lateral lobes with the posterior angles little laminate, subacute produced, obliquely truncate behind: the lateral carinæ on each side of the pronotum between the shoulders and elytra formed in a wide arc far above the elytra (in *Hybotettix* it is sulcate). Elytra of moderate size; wings fully explicate, extended backward nearly to the pronotal apex. Femora elongate, margins entire, the antegenicular spines small, acute, the genicular spine little acute produced; posterior tibiæ somewhat curvate, little ampliate toward the

apices, the canthi armed with stout spines; the first and third tarsal articles equal in length, the three pulvilli of the first tarsal articles equal in length, but the first more rounded below than the rest. Length of body entire, female, 16·5 mm.; pronotum 15·5 mm.; width between the shoulders 3·5 mm.; posterior femora 7 mm.

One example from Bali, Doherty; Oxford Museum.

Genus Dasyleurotettix, Rehn.

1. *D. curriei*, Rehn, Proc. Acad. Nat. Science, Philadelphia, p. 658, 1904.

One example, a male, differs from the type in being less rugose on the pronotum, and in the frontal costa being narrower. From Natal, Africa; Oxford Museum.

Note.—This genus was formerly placed in the section *Cladonotæ*, but an examination of type specimens, recently acquired, convinces me that it belongs in the section *Tetrigiæ*, taking a place near *Tetrix*. Indeed this species recalls *Tetrix depressus*, Bris., as its nearest relative.

Genus Allotettix, Hancock.

1. *A. americanus*, sp. nov.

Ferruginous. Vertex little ascendant forward and distinctly narrowed, strongly narrower than one of the eyes, tricarinate; frontal costa sulcate above the posterior ocelli, the rami moderately divergent forward to the median ocellus, in profile roundly compresso-elevated, produced, between the antennæ; eyes roundly conoidal in profile, little elevated above the dorsum of pronotum; posterior ocelli rather conspicuously showing in advance of the eyes on a plane little below the middle; antennæ inserted distinctly before (below) the eyes, the articles strongly elongate, the first articles grossly compressed. Pronotum depressed, rugose, convex between the shoulders and somewhat narrow, the shoulders bicarinate, widely obtuse, posteriorly lengthily subulate, extended backward beyond the knees of the hind femora; median carina little compressed, lightly sinuate, little excavate behind the anterior margin; anterior prozonal carinæ distinctly expressed, slightly convex; lateral lobes with the posterior angles turned downward, obtuse. Elytra narrow and somewhat acuminate posteriorly; wings fully explicate, extended backward beyond the pronotal apex. Anterior and middle femoral margins entire; hind femora of ordinary form, the hind tibiæ rather stout, distinctly ampliate toward the apices, the margins armed with stout spines; the first articles of the posterior tarsi stout and scarcely

shorter than the third, the first two pulvilli of the first tarsal articles short and acute, the third pulvilli longer and somewhat flattened below but acute.

One example from Cachabi, Ecuador, S. America; Rosenberg; Oxford Museum.

Readily distinguished from the other members of this genus by the narrowed vertex, which is strongly narrower than one of the eyes and tricarinate, and also by the extended wings which pass beyond the pronotal apex.

Genus Otumba, Morse.

1. *O. quadrata*, sp. nov.

Somewhat resembling *scapularis*. Pale ferruginous; head little exserted, face oblique; vertex ascendant forward but very little narrowed, convex, advanced nearly as far as the eyes, the carinæ laterally little roundly compressed, at the front almost as wide as one of the eyes, middle carinate, sulcate on each side; frontal costa declivous above, between the antennæ little compresso-elevated, and sinuate below, between the posterior ocelli narrowly sulcate, evenly divergent forward to the median ocellus; eyes roundly conoidal, higher than the dorsum of pronotum; posterior ocelli placed between the lower third of the eyes; antennæ inserted distinctly before the ventro-anterior border of the eyes. Pronotum rugose or often rugulose, depressed, deplanate between the shoulders; median carina very low and indistinctly sinuate, almost straight posteriorly and lengthily acuminate, extended beyond the knees of the hind femora; prozonal carinæ distinct and parallel; humeral angles obtuse, bicarinate; lateral lobes with the posterior angles strongly reflexed outwards, rectangulate, but convexo-truncate behind. Elytra small, acuminate toward the apices; wings fully explicate reaching just beyond the pronotal process. Margins of anterior and middle femora little compresso-undulate; the posterior femora bearing a series of large tumose tubercles above on the outer faces, the antegenicular spine acute, but the genicular spine nearly wanting, posterior tibiæ very little ampliate toward the apices, the canthi sparingly spinose; the first and second pulvilli of the first tarsal articles equal in length; subacute, the third pulvilli little longer and more flattened below, Length of body entire, male and female, 12–13 mm.; pronotum 11–12 mm.; posterior femora 5–6 mm.

Five examples from Cachabi, Ecuador, S. America. Rosenberg; Oxford Museum.

Section TETRIGIÆ, Bolivar.

Genus PARATETTIX, Bolivar.

I recognize four Bornean species of *Paratettix*, which may be distinguished by the following key*—

1. Pronotum somewhat broad between the shoulders; the lateral lobes conspicuously reflected outwards, triangular and acute; first two basal pulvilli of the first tarsal articles spiculate . . . . . . *variabilis*, Bol.
2. Pronotum narrower between the shoulders; the lateral lobes little produced outwards, and angulate-subacute; the first two basal pulvilli of first tarsal articles not spiculate *angulobus*, sp. nov.
3. Posterior angles of the lateral lobes of pronotum narrowly rounded; vertex of head strongly narrower than one of the eyes; length of pronotum from 9 to 12 mm. . *histricus*? Stål.
4. Posterior angles of lateral lobes subtriangular, indistinctly turned outward; vertex of head narrowed forward, subequal or little narrower than one of the eyes; pronotal process often extended as far as the wings; length of pronotum from 12 to 15 mm. . *lineatus*, sp. nov.

1. *P. variabilis*, Bolivar, Ann. Soc. Ent. Belg. xxxi, p. 276, 1887.

Three examples from Kuching, N.W. Borneo, R. Shelford; Oxford Museum.

2. *P. angulobus*, sp. nov.

A very slender-bodied species, with prominent globose eyes, fusco- or grayish-ferruginous; vertex ascendant forward, strongly narrowed, tricarinate, at the front much narrower than one of the eyes, occiput behind the eyes exposed; eyes higher than the dorsum of pronotum; frontal costa rather roundly compresso-elevated between the antennæ, not at all sinuate; apical articles of maxillary palpi oval; the antennæ inserted almost between the inferior border of the eyes. Pronotum often lightly rugulose, depressed, little ascendant behind the anterior margin, subdeplanate between the shoulders and bearing

* One of the common species of *Tetriginæ* in Borneo is *Paratettix contractus* of Bolivar. This species is considered a *Tetrix* here, and will be so treated further on under that heading.

an abbreviated costa on each side; the shoulders indistinctly bicarinate; median carina forward little sinuate, horizontally straight posteriorly, process lengthily acuminate, strongly extended beyond the knees of the hind femora; posterior angles of lateral lobes reflexed outwards and angulate-acute. Elytra oval; wings fully explicate, extended beyond the pronotal apex, caudate. The first and third articles of the posterior tarsi equal in length, the three pulvilli of the first tarsal articles nearly equal in length. Length of body entire, male and female, 13–14 mm.; pronotum 11–12 mm.; posterior femora 4·6–5 mm.

Five examples from Kuching, N.W. Borneo; Oxford Museum. Two of these specimens from the Sarawak Museum, Nos. 353 and 351, the others from R. Shelford.

3. *P. histricus*? Stål, Freg. Eüg. resa. Ins. Orthopt., p. 347, 1860.

One example from Kuching, N.W. Borneo; R. Shelford, Oxford Museum.

4. *P. lineatus*, sp. nov.

Ferruginous, legs lighter. Head not at all exserted; vertex narrowed forward, subequal in width to one of the eyes; the frontal costa arcuate; eyes moderately small, globose; posterior ocelli unusually large and conspicuously showing just in advance of the middle of the eyes. Pronotum lengthily subulate, rather smooth, bicarinate at the shoulders, the dorsum convex between the shoulders and bearing abbreviated costa on each side forward; lateral lobes not at all reflexed outwards, truncate; elytra oblong; wings fully explicate, extended backward just beyond the pronotal apex. Femoral carinæ entire; the first tarsal articles having the second pulvilli very little smaller than the first and third, all the pulvilli flattened below, not spiculate. Length of body entire, male and female, 13·5–16 mm.; pronotum 12–15 mm.; posterior femora 5–6 mm.

Six examples from Kuching, N.W. Borneo. One of these specimens from Sarawak Museum, No. 345, the rest from R. Shelford; Oxford Museum.

This species may possibly be a *Coptotettix*.

Genus Apotettix, Hancock.

1. *A. proximus*, sp. nov.

A South American form of rather small stature, with subquadrate vertex, resembling *Paratettix frey-gessneri*, and dimorphic in wing-length. Greyish, the tibiæ and tarsi fusco-annulate. Vertex little

wider than one of the eyes, longitudinally fossulate on each side of the distinct median carina, the front margin subtruncate; frontal costa rather widely sulcate, in profile little arcuate produced between the antennæ, subsinuate above and below; eyes of moderate size. Pronotum little rugose granulate, somewhat deplanate between the shoulders, acuminate posteriorly and extended to or beyond the knees of the hind femora; median carina percurrent, compresso-arcuate forward before the shoulders, little lowered and often subsinuate backward, but straight on the process; lateral lobes little reflexed outwards, the posterior angles distinctly rounded or obtuse. Elytra oblong; wings fully explicate, abbreviated and not extended to the apices of the posterior femoral knees, or passing beyond the apex of pronotal process or even caudate. The first tarsal articles with the first and second pulvilli small and spiculate, the third much longer and flattened below. Length of body entire, male and female (short-winged form), 7·5–9 mm.; pronotum 7–7·8 mm.; posterior femora 4·5–5 mm. Long-winged form, male, 10 mm.; pronotum 8 mm.; posterior femora 4·5 mm.

Five examples, from Cachabi and Paramba, Ecuador, S. America; Rosenberg.

Genus EUPARATETTIX, Hancock.

1. *E. personatus*, Bolivar, Ann. Soc. Ent. Belg. xxxi, p. 278, 1887.

One example from West Java; H. Fruhstorfer. Two examples from N.C. Province, Ceylon; Oxford Museum.

2. *E. mimus*, Bolivar, Ann. Soc. Ent. Belg. xxxi, p. 278, 1887.

One example from Penang Island, E. L. Meyer, coll.; Oxford Museum, No. 3451.

3. *E. indicus*, Bolivar, Ann. Soc. Ent. Belg. xxxi, p. 281, 1887.

Four examples from (Assam ?) India; Oxford Museum.

4. *E. similis*, sp. nov.

A rather small form, with the head little exserted. Vertex hardly narrowed forward, nearly equal or subnarrower than one of the globose eyes, little ascendant forward; median carina distinct, sulcate on each side; the frontal costa slightly compresso-arcuate between the antennæ, declivous above; eyes barely higher than the dorsum. Pronotum lengthily acuminate posteriorly, little

rugose, without supernumerary costa, convex between the shoulders, the humeral angles distinct and carinate; the anterior prozonal carinæ very small, subobsolete; median carina percurrent, slightly incrassate, little compresso-elevated forward and there often subundulate, but straight posteriorly; pronotal process strongly extended backward beyond the hind femoral knees; lateral lobes distinctly turned down, the posterior angles narrowly rounded. Elytra oval; wings caudate. Anterior and middle femoral margins entire; posterior femoral carinæ above arcuate; the first and third articles of the posterior tarsi equal in length, the first tarsal articles having the first and second pulvilli spiculate, the third nearly as long as the first and second united and flat below. Length of body entire, male and female, 11–12 mm.; pronotum 9–10 mm.; posterior femora 4–4·7 mm.

Six examples from Banguay, and one from Kina Balu-Borneo, in the author's collection. Examples are in the Oxford Museum from the Philippines, Nos. 2769 and 2770, and from Kuching, N.W. Borneo, R. Shelford.

Genus Tetrix, Latreille.

1. *T. contractus,* Bolivar, Ann. Soc. Ent. Belg. xxxi, p. 281, 1887.

Numerous examples in the collection of the Oxford Museum, from Kuching, N.W. Borneo, R. Shelford.

This species seems nearer to *Tetrix* than *Paratettix.* The vertex is subwider than one of the eyes and rounded, not truncate; the frontal costa being distinctly sinuate, excavate between the eyes. It is apparently one of the commonest species in Borneo. This species was placed in the genus *Paratettix* by Bolivar.

2. *T. atypicalis,* Hancock, Spolia Zeylanica ii, p. 143, 144, 1904.

Two examples from Pundaluoya, Ceylon; Oxford Museum.

3. *T. a. ceylonus,* Hancock, Spolia Zeylanica ii, p. 143, 144, 1904.

Two examples from Pundaluoya, Ceylon; Oxford Museum.

4. *T. cuspidatus,* sp. nov.

Resembling *Tetrix contractus.* Greyish, with the dorsum behind the shoulders often fusco-maculate. Vertex little depressed, not at

all narrowed forward, anteriorly convex, tricuspidate, subequal in width to one of the eyes, the fronto-marginal carinæ laterally little compresso-elevated and acute, viewed in profile the cusps often little elevated above the eyes, lateral margins of vertex not at all sinuate, median carina produced, in profile protuberant; frontal costa in profile strongly sinuate, excavate between the eyes, little compresso-elevated between the antennæ and excavate below, the rami moderately and evenly divergent to the median ocellus. Pronotum depressed, between the shoulders convexo-deplanate, the humeral angles distinct, carinate, and slightly produced laterally; median carina percurrent but sinuate, little compresso-elevated before shoulders and little excavate just behind the anterior border, pronotal process strongly extended backward beyond the apices of the posterior femora; posterior angles of the lateral lobes rounded, the inferior margins little reflexed outwards. Elytra oblong or somewhat oval with the apices subacuminately rounded; wings caudate. Anterior and middle femoral margins distinctly compressed, the superior margins of the anterior femora distinctly compresso-elevated, the carinæ undulato-arcuate; middle femoral carinæ above and below undulate; the external paginæ of the posterior femora rugose, the oblique costa strongly expressed and rugose-granulate; the first and third articles of the posterior tarsi about equal in length, the first and second pulvilli subacute, the third nearly as long as the first and second united and flat below. Length of body entire, male and female, 12·5–13 mm.; pronotum 10·5–11 mm.; posterior femora 4–4·5 mm.

Four examples from West Java, Pengalengan, 4000 ft.; Oxford Museum.

Genus Hedotettix, Bolivar.

1. *H. gracilis*, Haan, Bijdr. Orthopt., p. 169 (= *festivus*).

Six examples from Java, H. Fruhstorfer; Oxford Museum. Four examples from Ceylon and one from Chenapungi, also in Oxford Museum.

2. *H. guibelondoi*, Bolivar, Ann. Soc. Ent. Belg. xxxi, p. 285, 1887.

One example referable to this species, from the Philippines, in the Oxford Museum, No. 2771.

3. *H. burri*, Hancock, Occas. Memoirs Chicago Ent. Soc., vol. i, No. 1, p. 10, 11, 1900.

Originally described from a male example from Madagascar under the genus *Telmatettix.* A second specimen in the Oxford Museum from the same locality, being a female, allows me opportunity of revising my opinion of this species. This species resembles *Paratettix scaber* from Africa, and it may be quite possible that it is this species. The antennæ are inserted between the inferior part of the eyes, as in *Hedotettix.*

4. *H. celebicus,* sp. nov.

A very slender-bodied species; greyish-cinereous or flavous, variegated with fuscous. Head little exserted; vertex scarcely narrowed forward, narrower than one of the eyes, sulcate on each side of the median carina, not at all ampliate toward the front; frontal costa slightly arcuate, the face in profile not at all sinuate, rami divided distinctly above the posterior ocelli, moderately sulcate. Pronotum truncate anteriorly, subtectiform between the shoulders, posteriorly lengthily acuminate, the process extending beyond the femoral apices; median carina percurrent, somewhat acute, little elevated between the shoulders; dorsum granulate; the prozonal carinæ parallel; posterior angles of the lateral lobes turned down and narrowly rounded. Elytra with the apices somewhat widely rounded; wings strongly caudate. Anterior femoral carinæ straight; intermediate femora, in the male, little ampliate toward the bases, in the female, subnarrowed; the first tarsal articles with the first and second pulvilli acute-spiculate, the third much longer than the second, and straight below, the apices acute. Length of body entire, male and female, 11–14 mm.; pronotum 9–10 mm.; posterior femora 4–5 mm.

Three examples from Macassar, Celebes, Doherty; Oxford Museum.

Genus Coptotettix, Bolivar.

1. *C. tuberculatus,* Bolivar, Ann. Soc. Ent. Belg. xxxi, p. 117, 1887.

Three examples from Kuching, N.W. Borneo, R. Shelford; Oxford Museum.

2. *C. rotundatus,* sp. nov.

Fuscous, the legs sometimes flavous or fusco-variegated; vertex not produced beyond the eyes, strongly narrowed forward, about equal in width to one of the eyes, fossulate on each side, in profile little roundly elevated above the eyes; the frontal costa strongly roundly produced in advance of the eyes, the rami dividing above the

posterior ocelli, moderately divergent forward to the median ocellus; the posterior ocelli placed in advance of the upper third of the eyes. Pronotum lengthily subulate, the dorsum rugose, often conspersed with very slightly elevated and elongated rugæ and coarsely granulate; median carina undulate, here and there slightly incrassate, but the other carinæ low and thin, the anterior prozonal carinæ very indistinct, granulate, and convergent backward; posterior angles of the lateral lobes narrowed and rounded. Elytra oval, the apices rounded; wings fully explicate and passing the pronotal apex. Anterior and intermediate femora elongate, the carinæ entire; the first articles of the posterior tarsi distinctly longer than the third, the first and second pulvilli of the first tarsal articles more acute than the third, the third being flat and longer than the second. Length of the body entire, male and female, 13–14·5 mm.; pronotum 11·5–13 mm.; posterior femora 5·5–6·5 mm.

Four examples from Kina Balu in the author's collection, and one from Kuching, N.W. Borneo, R. Shelford; Oxford Museum.

In this species the antennæ are inserted between the lower third or fourth of the eyes. The specific name *rotundatus* refers to the facial costa.

3. *C. parvus*, sp. nov.

This may be the short-winged form of *Coptotettix tuberculatus*. It is a small form with abbreviated wings and pronotum; the posterior angles of the lateral lobes turned down, and slightly more obtuse; the dorsum of pronotum rugose and bearing tubercles, some of which are abbreviated linear in form. The vertex resembles that of *tuberculatus*. Length of body entire, male, 8 mm.; pronotum 7 mm.; posterior femora 5·5 mm.

One example from Kuching, N.W. Borneo, R. Shelford; Oxford Museum.

4. *C. inflatus*, Krauss, Denkschr. Naturw. Ges. Jena Bd. 8, 1903, vol. iv, p. 745, Pl. LXVII, fig. 10, 1902.

Six examples from Java; Oxford Museum.

Section BATRACHIDEÆ, Bolivar.

Genus PHLŒONOTUS, Bolivar.

1. *P. sinuatus*, sp. nov.

Similar to *natalensis*; greyish, fusco-variegated. Vertex wide, completely covered, strongly produced; face in profile arcuate;

frontal costa strongly advanced beyond the eyes, the rami somewhat widely sulcate, divided above the posterior ocelli near the vertex, and slightly divergent forward. Pronotum anteriorly produced scarcely beyond the head, the front margin on each side straight, convergent forward, angulate, but with obtuse apex; dorsum strongly compresso-cristate ; the median carina forward between the shoulders strongly sinuate, posteriorly acuminate, extended little beyond the hind femoral apices. Elytra rather wide, oval, bearing a large black macula transversely intersected by a light fascia near the apices ; wings fully explicate and extended beyond the pronotal apex. Posterior femora somewhat incrassate ; the first and third articles of the posterior tarsi subequal in length, the three pulvilli of the first tarsal articles nearly equal in length. Length of body entire, male, 14 mm.; pronotum 12·5 mm.; posterior femora 7 mm.

One example from Natal or Orange River Colony, F. N. Brown; Oxford Museum, No. 3356.

Genus Tettigidea, Scudder.

1. *T. planus*, sp. nov.

This species has no spine at the termination of the superior carina of the middle femora, and the elytra are plainly coloured without macula ; it resembles Scudder's species *Tettigidea cuspidata.*

Body granulate ; ferruginous, often fusco-variegated. Vertex distinctly wider than one of the eyes, somewhat depressed and smooth, narrowed forward, the supraocular lobes small, the front margin advanced about as far as the eyes, the median carina absent, the frontal carinulæ on each side very little compressed, little rounded-concave ; frontal costa narrowly sulcate, little compresso-elevated between the antennæ ; maxillary palpi yellow, widely compresso-dilated at the apices, the apical articles oval. Pronotum anteriorly acute spiniform produced nearly as far as the front of vertex, the spine nearly straight, the front margin on each side of the spine strongly concave ; posteriorly cuneate, extended backward nearly to the apices of the hind femoral knees ; dorsum granulate, between the shoulders somewhat tectiform ; median carina little incrassate, subundulate, nearly horizontal, little compressed and percurrent. Elytra elongate, acuminate toward the bases and apices, the external faces plain coloured and granulate ; wings abbreviated. Hind femora elongate; the tibiæ fuscous with pale annulation near the bases, the first and third articles of the posterior tarsi subequal, the first, second and third pulvilli respectively gradually increasing in

length and subflattened below, not acute. Length of body entire, female, 12·8 mm.; pronotum 11·5 mm.; posterior femora 7·6 mm.

One example from Paramba, Ecuador; Rosenberg.

Genus Scaria, Bolivar.

1. *S. fasciata*, sp. nov.

This is a remarkably graceful species, narrow between the shoulders, and having the pronotum anteriorly only little ascendant. Body granulate, flavo-ferrugineous, on either side bearing a broad, black, longitudinal fascia, the face, lower part of lateral lobes of pronotum and sides flavous, legs flavous, often tinged with fuscous. Eyes strongly globose; face oblique; vertex subtruncate, nearly equal in width to one of the eyes, scarcely advanced so far as the eyes, little narrowed forward and smooth, the median carina wanting; the frontal costa starting at the vertex little lower than the eyes, divides between the posterior ocelli and is arcuately protuberant forward between the eyes; superior ocelli large, conspicuously showing in profile just in advance of the middle of the eyes. Pronotum anteriorly acute spiniform produced, the antero-dorsal margin on either side of the spine roundly excavate, posteriorly lengthily extended beyond the apices of the hind femoral knees; dorsum between the shoulders convex, narrow; humeral angles bicarinate; anterior prozonal carinæ only little expressed, slightly divergent backward; median carina somewhat undulate, often little compresso-elevated forward between the shoulders, nearly horizontal, and forward at the front margin with the spine little ascendant and uncinate. Elytra oblong, with a pale spot near the apices varying in intensity and size; wings fully explicate, extended beyond the pronotal apex. Posterior femora elongate, knees black, the superior carinæ forward black, with pale spots; tibiæ black but pale annulate toward the base and the apices, the canthi serrulate and rather feebly plurispinose; the three pulvilli of the first tarsal articles equal in length. Length of the body entire, male and female, 13–15 mm.; pronotum 11–14 mm.; posterior femora 5·5–6·3 mm.

A number of examples from Cachabi, Ecuador, Rosenberg; Oxford Museum, and in the author's collection.

Explanation of Plate XXI.

[*See Explanation facing the* Plate.]

H. Knight del. et lith.

West, Newman imp.

NEW SPECIES OF TETRIGINÆ.

IV. *The Larva of* Collyris emarginatus, Dej. By R. Shelford, M.A., F.L.S.

[Read March 6th, 1907.]

PLATE III.

In Dec. 1905 I exhibited before this Society some specimens of the wood-boring larva of the Tiger-beetle *Collyris emarginatus*, Dej., and made some remarks thereon, which are published in the Proceedings of date Dec. 6th, 1905. It is to Dr. J. C. Koningsberger of the Zoological Museum at Buitenzorg, Java, that we owe the discovery of this very interesting larva. From a brief description of its habits published in "Mededeelingen uit'Slands Plantentuin," vol. xliv, p. 113, 1901, we learn that the larva excavates a burrow in the twigs of coffee-shrubs and that it feeds on the ants and aphides which crawl over the entry to the burrow; pupation takes place in the burrow. No adequate figure of the larva and no account of its external features have yet been published, but I am now enabled to supply some information on these points, thanks to Dr. Koningsberger, who has most kindly sent me two consignments of larvæ. I gladly seize this opportunity of recording my gratitude to my generous correspondent.

The burrows occupied by the larvæ of *Collyris emarginatus* are situated in the central pith of twigs of not more than 5 mm. in diameter; the woody part of the twig does not appear to be attacked at all. The burrow is generally half as long again as the larva occupying it, so that there is room for to-and-fro movements of the occupant. Close to the anterior end of the burrow is a small circular orifice passing through the woody tissue of the twig and placing the burrow in communication with the outer world; the outer margin of this orifice is raised, so that the entry to the burrow appears to be countersunk. This raised margin is brought about by the swelling of the bark of the twig at this point,—a pathological result of its puncture.

Though the oviposition of this Cicindelid has not been actually observed, there can be little doubt but that the adult female perforates the woody tissue of the twig and deposits her egg in the central core of spongy pith. The larva has no organs adapted for boring through wood; the mouth-parts are not very different from those of the larvæ of *Cicindela* spp., the legs are modified merely for burrowing in relatively soft and non-resisting substances, and may well be compared with the legs of Coprid and Passalid beetles, of *Gryllotalpa* and of Panesthiid cockroaches. As already stated, the burrows are made in the centre of twigs and the woody tissue of the twigs is not attacked; the larva on hatching out from the egg has merely to dig out the soft pith of the twig in order to form for itself a cylindrical burrow, and we may presume that the *débris* is expelled from the mouth of the burrow.

As is well known, the adult females of all species of *Collyris* are furnished with a complex genital armature, which, however, has never been really adequately figured or described. If a dried specimen of *C. emarginatus* be examined with a simple lens the gonapophyses appear to consist of a pair of strongly chitinised *crotchets* projecting beyond the last visible tergite and of a pair of short down-curved spines projecting beyond the last visible sternite. Each crotchet is made up of three stout hooks directed upwards and of a much smaller hook; in some specimens these hooks project considerably, in others they are withdrawn almost entirely into the abdominal cavity. When the dorsal integument is removed, it will be seen that the crotchets and spines are attached to a chitinous tube occupying the greater part of the abdominal cavity of the last three segments. The whole apparatus can be removed bodily from the insect and after boiling in caustic potash mounted and examined under the microscope, when it will be seen that the chitinous tube is a segmented structure (Plate III, fig. 8), the number of the segments being apparently four. I have not been able to make out in the first (*i. e.* the most proximal) segment the number of sclerites composing it, but the second segment is made up of two lateral sclerites which meet each other in the mid-dorsal and mid-ventral line, also of a large spoon-shaped sclerite which embraces the ventral half of this and the succeeding segments, runs backwards to the tip of the abdomen and bears on its posterior margin the two

short decurved spines that have already been mentioned.* The third segment is composed of the lateral sclerites, and a median dorsal sclerite, which runs backward and ends between the base of the crotchets (Plate III, fig. 9. *d*); the lateral sclerites meet each other in the mid-ventral line. The fourth segment is open ventrally, the lateral sclerites are now pillars bearing the crotchets and each has a small hook on the outer aspect, the dorsal sclerites are represented perhaps by a pair of oval setigerous plates (Plate III, fig. 9. *s.p.*) covering the base of the crotchets. Each crotchet consists of three strong curved hooks, the second of which has on the ventral aspect an inwardly projecting flange (Plate III, fig. 10. *f.*); they are articulated to the lateral sclerites by a transverse joint but, so far as I know, are not movable independently of the chitinous tube. This is all that can be made out from an examination of dried specimens and I am unable to afford any information as to the exact relations of these parts to the other internal organs of the beetle. But there can be no reasonable doubt that the segmented chitinous tube is composed of retracted terminal segments, the last one of which bears appendages in the form of crotchets, and it is these appendages only which can be regarded as the morphological equivalents of the female gonapophyses of the Terebrant Hymenoptera. The *modus operandi* of the genital armature of *Collyris* is obscure, but I have little doubt of its efficiency as an instrument for boring through wood of no greater hardness than young coffee twigs. Strictly homologous organs occur in other Cicindelidæ and doubtless in every case they function as boring tools. So far as is known—though observations on the subject are woefully inadequate—the Cicindelidæ deposit their eggs *in* substances, and not *on* surfaces, and it does not require a great stretch of imagination to suppose that the arboreal *Collyris* only departs from the habits of its allies so far as to deposit her eggs inside the twigs of trees and shrubs. It is of interest to note that the pair of decurved ventral spines are only well-developed in the arboreal species,†

* These spines have been described elsewhere as attached to the last visible sternite, but this is manifestly incorrect.

† Wallace states that *Therates labiata* in Amboina is arboreal and in this species the ventral spines are well developed; in other species that I have examined these spines are minute or absent, and Canon Fowler informs me that occasionally they are modified to form comb-

and I would suggest that in the case of *Collyris* at any rate they function as guides for the passage of the egg through the aperture bored in the woody tissue of the twig. Species of *Cicindela,* to take an example, would have presumably no difficulty in depositing their eggs in the burrows excavated for their reception; the burrow is of sufficient diameter to admit the tip of the abdomen and the egg can be simply dropped before the tip of the abdomen is withdrawn after the operation of excavation. The entrance to the burrow occupied by the larva of *Collyris emarginatus* is not large enough to admit the tip of the abdomen of the adult female, as can be shown by measurements, but the two ventral spines fit into it with ease. Without these spines it is difficult to see how the female *Collyris* could be certain of passing her egg through the aperture in the wood which she has made; she would be liable to deposit it rather on the outer surface of the twig, whence it would drop to the ground, but with the ventral spines inserted in the aperture the egg can readily pass from the oviduct to the place prepared for it.

Description of the Larva. (Plate III, figs. 1–10.)

The largest specimen in my possession is 12 mm. in length. The head is typically Cicindelidan; that is to say, it is strongly chitinised, swollen and concave beneath, flattened above; the mouth-parts are prominent and point in an upward direction. The antennæ are short and four-jointed. There are two ocelli borne on each side of the head near the origin of the antennæ; the area surrounding these ocelli is much darker than the rest of the head and is somewhat inflated. The labrum is broad and transverse with a quadrangular projection from the middle of the front margin, flanked on each side by a tooth; this quadrangular projection is ridged and has a blunt tooth on each side. The mandibles are strong and curved, each bears a tooth on its inner margin at the centre; distad of this tooth the inner border of the mandible is grooved, proximad of it the inner border is sharp and trenchant. The maxillæ consist of a small *cardo*, a stout triangular *stipes*, bearing a two-jointed palp and a narrow *galea* almost equal to the palp in length and furnished with

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like structures. The species of *Therates* that I took in Borneo were not, so far as I can remember, arboreal, and in these the ventral spines are very small indeed. The Australian genus *Distypsidera* is said to be arboreal and in this genus also the ventral spines are present.

a few strong spines (Plate III, fig. 3). The labium is cordiform, densely hirsute above and with a pair of short two-jointed palps; the anterior angles of the basal joints of these palps are spiniform beneath and the tip of the apical joints is beset with numerous sensory pits (Plate III, fig. 4).

The body consists of 13 segments and is seen at once to differ from that of a typical Cicindelid larva by the absence of a marked sigmoid flexure and by the absence of large dorsal tubercles armed with strong hooks on the eighth segment. The *Collyris* larva in fact "fits" its burrow much better than does the *Cicindela* larva, it is thus able to brace itself at the top of the burrow without pronounced curvature of the body; the walls of its burrow being of a denser and harder texture than sand or earth accounts for the absence of long hooks on the eighth segment. The prothorax is as broad as the head; the pronotum is trapezoidal with rounded posterior angles and is strongly chitinised. From the mesonotum backwards to the eighth segment, the segments increase in breadth. The eighth segment is swollen dorsally forming a hump and the hump carries two curved series of small hooks, each series being composed of three hooks; the hooks are of a rather peculiar shape, which can best be understood by a reference to the Plate (fig. 5). In addition to the hooks are numerous stout setæ; both hooks and setæ are directed forwards. The three segments immediately behind the eighth are slightly narrower than it; the twelfth segment is much narrower and shorter and the thirteenth segment is small and sucker-like with six short spines and numerous fine setæ on its posterior margin. Segments 4 to 12 bear on each side in a dorso-lateral position a mamilliform tubercle furnished with three setæ, and a minute mamilliform tubercle with two setæ occurs on the ventral surface of these segments. These tubercles and setæ together with the dorsal armature of the eighth segment doubtless serve to brace the larva in its burrow.

Of the legs the following parts can be distinguished:—femur, tibia and tarsus. In the second and third pairs the femur is flattened and plate-like, with rounded angles; the tibia is rather slender, about two-thirds the length of the femur and with some setæ along its lower border and at its distal end; the tarsus consists of three joints, the terminal hook or claw being included as one joint; the first or basal point is ringed with setæ, the second has some setæ and, in addition, on its outer aspect a blunt tooth (Plate III, fig. 7). The first pair of legs is very different in shape; the femur is flattened and triangular with a row of setæ along its outer aspect; the tibia is short and very stout, broader distally than proximally, its lower anterior angle is produced to form a strong and acute tooth with

secondary teeth on the upper border, a small blunt tooth also occurs at the upper anterior angle on the outer aspect; the tarsus is triangular, the basal joint is almost as broad as long with a blunt tooth on its outer aspect, the second joint also is furnished with a tooth on its outer aspect and both joints are beset with setæ (Plate III, fig. 6). The second and third pairs of legs are carried with the femora straight out from the body, the tibiæ bent upwards; no doubt they brace against the sides of the burrow and serve to steady the larva when it catches some large or active insect. The front legs are plainly adapted for excavating the soft core of the twig in which the larva lives.

In conclusion I would beg to express my thanks to Dr. Sharp, F.R.S., Canon W. W. Fowler, and Mr. V. E. Shelford of Chicago University, for the kind help and useful criticism that they have offered me in the preparation of this account of a most interesting insect.

EXPLANATION OF PLATE III.

[*See Explanation facing the* PLATE.]

ADDENDUM.

AFTER the foregoing account went to press, I received from Dr. D. Sharp a letter sent to him from Hongkong by Mr. F. Muir, in which Mr. Muir announces the discovery by himself and Mr. J. C. Kershaw of a wood-boring Cicindelid larva. Mr. Muir writes that the burrow "runs up the stem, the entrance being at the lower end. It [the larva] waits with its head at the entrance of the burrow and whenever an ant or a fly crawls up the stem within reach it quickly darts out its head and catches its prey." Apparently only one specimen was secured, and this, with the piece of wood containing the burrow, Dr. Sharp has kindly handed to me for examination. The larva is larger than that of *Collyris emarginatus*, measuring 12 mm. in length, but it can, I think, be referred to the genus *Collyris* without much doubt. There are only two pairs of ocelli; the legs are very similar in appearance to those of *C. emargi-*

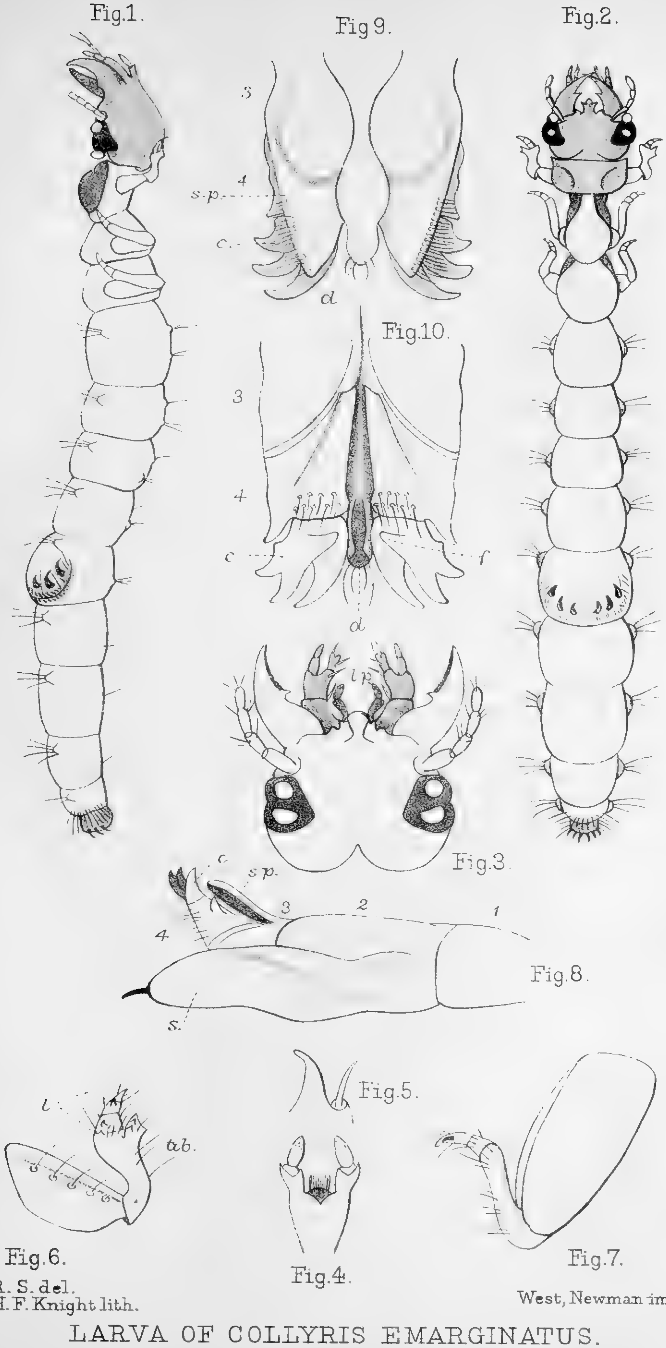
natus; the eighth tergite bears on each side three small forwardly-directed hooks and its posterior margin is fringed with setæ; the terminal segment is armed on its posterior margin above with eight short spines arranged in two groups of four on either side of the middle line. In fact, such differences as exist between the two larvæ may be regarded as specific rather than generic. In one feature the Hongkong larva differs markedly from *C. emarginatus*; the metathorax is bent down almost at a right angle to the mesothorax and the first abdominal and succeeding segments are again bent up at an acute angle to the metathorax, thus producing a very sharp flexure of the body in this region. I cannot be sure, however, that this is not due to the undue contraction of the specimen after being placed in alcohol. The burrow is 24 mm. long and about 3·5 mm. in diameter, it has been formed by the excavation of the central medulla of pith; the affected part of the stem is dilated, being 7 mm. in diameter, whereas above and below the burrow it is only 4 mm. in diameter. This, I expect, is a pathological result of the injury caused by the larva. I have observed something very similar in the stems of a herbaceous plant tenanted by ants, that I found at the foot of Mt. Penrisen in Sarawak.* The consequence of this dilation of the stem is, that the burrow itself is relatively of much greater diameter than that made by the *emarginatus* larva; the dilation appears to be caused, not by a thickening of the wood, but by the expansion outwards with concomitant thinning of the walls, just as a bulb may be blown in the middle of a glass tube. It would be interesting to learn if this dilation of the stem and expansion of the burrow occurs synchronously with the growth in size of the larva. Mr. Muir's observation that the larva, when seizing its prey, rushes a short distance out of its burrow, is of considerable interest in connection with the fact that the entrance to the burrow cannot be enlarged by the larva as it increases in size. The entrance to the burrow of a *Cicindela* larva is a miniature pitfall, the head of the larva being the bottom of the trap; when an insect stumbles into the pitfall it is seized and the captor falls down to the bottom

* If this interpretation is correct it lends considerable support to the view that the enormous swellings on the stems of myrmecophilous plants of the genera *Myrmecodia* and *Hydnophytum* originated as pathological responses to irritant stimuli.

of its burrow with its prey. It is necessary that the head of the larva should always fit more or less accurately the entrance to its burrow, but the same necessity does not arise in the case of the *Collyris* larva, for here the burrow is a hiding-place or lair from whence the animal emerges to capture its prey; so long as the entrance to its lair is not too small it cannot particularly matter what size it is.

Explanation of Plate III.

Fig. 1. Larva, side view × 8.
2. Larva, dorsal view × 8.
3. Head of larva, dorsal view ; *l.p.*, labial palps × 33.
4. Labium, ventral view × 33.
5. One of the hooks from the 8th segment × 33.
6. Front leg ; *t.* tarsus, *tib.* tibia × 33.
7. Second leg ,, ,, × 33.
8. Genital apparatus of adult female, side view ; 1—4, numbers of segments, *s*, spoon-shaped sclerite borne by 2nd segment and bearing at apex one pair of decurved spines, *c*, crotchets, *s.p.* setigerous plate borne by 3rd segment × 16.
9. Apex of above, the spoon-shaped sclerite removed, dorsal view ; lettering as before. *d*, median dorsal sclerite of 3rd segment × 52.
10. Ditto ventral view, *f.* flange × 52.



R. S. del.
H. F. Knight lith.

West, Newman imp.

LARVA OF COLLYRIS EMARGINATUS.

PRELIMINARY LIST

OF

COLEOPTERA

OBSERVED IN THE

NEIGHBOURHOOD OF OXFORD,

FROM

1819 to 1907.

Compiled for the Ashmolean Natural History Society of Oxfordshire, from all available records, by

JAMES J. WALKER,

Hon. M.A., R.N., F.L.S.,

Secretary of the Entomological Society of London.

[*Reprinted from the Ashmolean Natural History Society Report for 1906.*]

A PRELIMINARY LIST OF THE COLEOPTERA OF THE OXFORD DISTRICT.

By JAMES J. WALKER, Hon. M.A., R.N., F.L.S., &c.

At the invitation of the Ashmolean Natural History Society of Oxfordshire, I have in the following pages attempted to enumerate the species of *Coleoptera*, or beetles, that up to the present date have been found in the immediate neighbourhood of Oxford. Since the early part of 1904, when I first "pitched my tent" in the ancient city after my retirement from active service in the Royal Navy, and was privileged to be associated with the Society, I have devoted a large part of my time to the study of the Entomology of the neighbourhood, and as regards my favourite order of Insects, the *Coleoptera*, I have been rewarded with an unexpectedly large measure of success. But a period of less than three years is altogether inadequate, even for the most zealous of collectors, to do justice to the beetle-fauna of so rich and varied a district as the country within a few miles of Oxford undoubtedly is; and I should have been quite unable to undertake the compilation of this list, had not the way been paved for me by my kind friend Mr. W. Holland, of the University Museum, who has resided here since 1893, and has assiduously worked up the local insect-fauna. The very full and most valuable catalogue of the *Coleoptera* of Berkshire, in the "Victoria History of the Counties of England," was compiled by Mr. Holland, and as at least half of the district now under consideration falls in that county, this catalogue has been of the greatest possible assistance in drawing up the present list. To Mr. Holland also, I owe my first introduction to nearly all the best localities near Oxford; and my other colleagues in the "Hope Department," Messrs. A. H. Hamm and Joseph Collins, have given me much kind help, and their captures of *Coleoptera* have added materially to the number of species recorded in this list.

Besides the *Coleoptera* observed by us of late years, I have added to the list all the species recorded as taken near Oxford that I can gather from the various Entomological periodicals and other sources. The munificent founder of the Entomological department in the University Museum, the Rev. F. W. Hope, left

with his library an interleaved copy of Marsham's "Entomologia Britannica; Coleoptera," in which he has noted the capture of about 150 species of beetles at Oxford, made during the years 1819 to 1822, when he was an undergraduate of Christ Church. Through the kindness of Professor E. B. Poulton, F.R.S., I have been enabled to incorporate in the present List these notes, which record the capture of a good many of the less common forms, and of several species of altogether exceptional interest. Of these latter may be mentioned *Necrophorus germanicus*, L. and *Platycerus caraboides*, L., which have not been taken in this country for many years, and are omitted from all the more recent catalogues of British *Coleoptera*. The circumstances of the capture of these species are given in full detail by Mr. Hope, and many of the specimens exist, in excellent preservation, in the Museum collection of British beetles. That renowned Entomologist, the late Professor J. O. Westwood, F.R.S., recorded several species from the Oxford district, among them, for the first time as a British insect, the wonderful blind ant's-nest beetle *Claviger testaceus* (Proc. Entom. Soc. September 3rd, 1838); and in the third volume of the Transactions of the Entomological Society of London, and the earlier volumes of the "Zoologist," are a few interesting records from Oxford by Mr. F. W. Holme. To come to more recent times, the late Mr. J. W. Shipp, an energetic and promising young Coleopterist, recorded a considerable number of interesting species in the "Entomologist," vol. xxvi., p. 130 (1893), and the "Entomologist's Monthly Magazine" for 1893 and 1894 (vol. xxix., p. 89, and vol. xxx., p. 15); and notes on the *Coleoptera* of the district have been contributed by myself to the volumes of the latter periodical for 1905 and 1906.

For the purposes of this list I have practically restricted myself to a radius of seven miles from Carfax, the centre of the city of Oxford, this being about the limit at which one can effectively work a district by the aid of one's legs unassisted by a bicycle. For a locality situated in the Midland Counties, the present list of 1,399 species out of a total of about 3,290 for the British Islands, or 42·5 per cent. of the whole number, must be regarded as showing a richness in *Coleoptera* very much above the average. As considerable portions of the area are up to the present time almost untouched, many additions to our local list may reasonably be expected, and many more when the smaller and more difficult forms, especially in the water-beetles, *Staphylinidæ*, *Clavicornes*, &c., are more fully worked up than they are at present. Indeed, I have been compelled to altogether omit one family, the

Trichopterygidæ, owing to the difficulty, to any one but a specialist in the group, of dealing with these highly interesting but almost microscopic beetles.

The large extent of river-bank and low-lying water-meadow in our District is of course highly favourable to such beetles as delight in a humid habitat, and they are accordingly very well represented on the list. The extensive tracts of woodland are also very productive, though some at least of these are so strictly preserved nowadays as to be by no means easy of access for collecting; and it is especially desirable to confirm the numerous records of interesting species of insects of all orders from Bagley Wood, made when this once happy hunting-ground was freely open to past generations of Oxford Entomologists. The oolitic limestone country at Wytham, Shotover, and Elsfield yields many local species, and our "Reserve" at Cothill, with the marshy fields adjacent, is a highly productive little spot. But on the whole, the "sandy side" of Oxford, at Boar's Hill and especially near Tubney, has received the most attention, and has produced the greatest number of rare and interesting forms. A very remarkable feature of the latter locality is the number of species whose usual habitat is on coast sandhills, and which are only exceptionally met with inland; of these, *Harpalus anxius*, *Amara fulva*, *Homalota cæsula*, *Ocypus ater*, *Xantholinus tricolor*, *Orthocerus muticus*, *Syncalypta hirsuta*, *Crypticus quisquilius*, *Cteniopus sulphureus*, *Apion schönherri*, and *Cleonus sulcirostris*, may be specially mentioned in this connexion. The record by the Rev. F. W. Hope of "*Carabus*" (*Pogonus*) *chalceus*, Marsh., is open to question, as this species is confined to muddy salt-marshes on the coast; but Mr. Shipp has recorded *Dyschirius æneus*, a species frequenting the same habitat and constantly found with it, from "Hinksey" (Ent. Mo. Mag. 1893, p. 89).

In the compilation of the following List I have used our most recent "Catalogue of British Coleoptera," by Prof. T. Hudson Beare and Mr. H. St. J. K. Donisthorpe (London: O. E. Janson, March, 1904), the arrangement of which is practically the same as that of the most modern and most useful work on our native beetles, "The Coleoptera of the British Islands," by the Rev. Canon W. W. Fowler (London: Lovell Reeve and Co.). Where the observers are not specially mentioned, I have used the following abbreviations of their names:—

J. C. = Mr. Joseph Collins.
A. H. H. = Mr. A. H. Hamm.
W. H. = Mr. William Holland.
F. W. H. = Rev. F. W. Hope.
J. W. S. = Mr. J. W. Shipp.

No initials are appended to the localities where any species has been actually observed by myself. The species of local and restricted distribution are indicated by a single asterisk (*) before the specific name, and those that may be regarded as rare everywhere by a double asterisk (* *); the remainder being generally distributed, at any rate in the South and Midland portions of England.

INSECTA.

ORDER COLEOPTERA.

Family **Cicindelidæ.**

Cicindela campestris, L. The common Tiger Beetle. Locally plentiful in warm sunny places in early summer ; Bagley Wood, Tubney, &c.

Family **Carabidæ.**

*__Cychrus rostratus, L.__ In old stumps, sandpits, &c., not rare; Tubney, Wytham Park ; Shotover (*W. H.*).

Carabus catenulatus, Scop. Generally distributed, but not common, under stones, &c. ; "Heddington Quarries, Oxfordshire" (*F. W. H.*).

C. nemoralis, L. On pathways and in gardens; very common.

C. violaceus, L. Much less common than the preceding.

C. granulatus, L. In rotten wood of willows, &c. Wytham, &c., not rare.

C. monilis, F. Rare ; Oxford (*A. H. H.*) ; Shotover, Boar's Hill, King's Weir, Wheatley, singly (*W. H.*).

*__Calosoma inquisitor, L.__ Bagley Wood, on oaks, sometimes common (*W. H.*). "I took 3 of them in Bagley Wood near Oxford in May, 1820, while beating the Oak Trees" (*F. W. H.*).

Notiophilus biguttatus, F.
N. substriatus, Wat.
N. aquaticus, L.
N. palustris, Dufts.
} All these are more or less common and generally distributed, on pathways, &c.

*__N. rufipes, Curt.__ Among dead leaves at Bagley Wood, scarce (*W. H.*).

Leistus spinibarbis, F. Under stones, bark, &c., in damp places, general.

L. fulvibarbis, Dej. With the preceding, but less common ; Bagley Wood, &c.

L. ferrugineus, L. Under stones, dead leaves, &c., generally common.

Nebria brevicollis, F. Very common everywhere.

Elaphrus riparius, L. In wet muddy places ; Cherwell banks, Port Meadow, Tubney, &c. "Taken at Oxford on the muddy banks of the brooks and rivers" (*F. W. H.*).

E. cupreus, Dufts. With the preceding; Tubney, &c.

*__E. uliginosus, F.__ Once at Stadhampton (*J. W. S.*). "Taken at Oxford as the above species (*riparius*), and in the same situations' (*F. W. H.*).

Loricera pilicornis, F. Chiefly in woods under stones, &c. ; Bagley, Hen Wood, &c.

Clivina fossor, L. Under stones, &c., in damp places ; common.

C. collaris, Hbst. Not common Otmoor (*W. H.*).

*Dyschirius æneus, Dej. "Hinksey" two examples (*J. W. S.*).
D. globosus, Hbst. In wet places; Tubney, Wytham Park, Yarnton, &c.
*Panagæus crux-major, L. Cowley (*J. W. S.*).
*P. quadripustulatus, Sturm. Under stones, &c., in sandy places; Shotover (*A. H. H.*); Tubney, sometimes not rare in spring (*W. H.*).
*Badister unipustulatus, Bon. Cowley (*J. W. S.*).
B. bipustulatus, F. In damp tufts of grass, &c.; generally common.
*B. sodalis, Dufts. In damp places, rather scarce; Summertown, Yarnton.
*Licinus silphoides, F. Under stones in small quarry, Elsfield, not rare (*J. C.*).
*[L. depressus, Payk. Taken by Mr. Holland at Wychwood Forest.]
Chlænius vestitus, Payk. In wet places, not rare; Cherwell banks, Port Meadow, near Wytham Park, &c.
C. nigricornis, F. Much rarer than the preceding; Godstow; King's Weir (*W. H.*).
*Oodes helopioides, F. In flood-refuse, wet tufts of grass, &c.; near Marston in numbers (*J. W. S.*), near Wytham Park (*J. C.*); Yarnton.
Stenolophus vespertinus, Panz. In wet places, scarce; Yarnton.
Acupalpus exiguus, Dej., v. luridus, Dej. On banks of pond, Boar's Hill, not rare.
A. meridianus, L. On walls and pathways; Summertown, &c.
*Bradycellus placidus, Gyll. In damp tufts of grass, not rare in winter; King's Weir, Wytham, Yarnton; also at Otmoor.
*B. distinctus, Dej. In tufts of grass, not very common; Tubney; Boar's Hill (*W. H.*).
B. verbasci, Dufts. Generally distributed and not rare.
B. harpalinus, Dej. In tufts of grass, &c.; Shotover, Tubney.
B. similis, Dej. In sandy places, not common; Bagley Wood, Boar's Hill (*W. H.*); Shotover.
Harpalus rotundicollis, Fairm. Under stones, &c., Cothill; Boar's Hill (*W. H.*).
*H. punctatulus, Dufts. Cothill, one under a stone, April, 1906 (*H. G. Champion*).
*H. azureus, F. Under stones in sandpit, Cumnor, with var. similis, Dej.
H. puncticollis, Payk. Under stones, chiefly in sandy places; not rare.
H. rufibarbis, F. With the preceding; Tubney; Elsfield (*W. H.*).
H. ruficornis, F. Under stones, rubbish, &c., common everywhere.
H. æneus, F. Under stones; very common.
H. rubripes, Dufts. Under stones, not common; Oxford (*J. W. S.*). Boar's Hill (*W. H.*); Tubney.
**H. discoideus, F. This usually rare and very local species is sometimes abundant under stones in sandy places at Tubney, and more sparingly at Boar's Hill, during the spring and summer months.
H. latus, L. In tufts of grass; Bagley Wood, not rare.
H. rufimanus, Marsh. Under stones in sandy places, common; Boar's Hill, Tubney.
H. anxius, Dufts. This seaside species is very common under stones on the sand near Tubney throughout the summer.
H. honestus, Dufts. (ignavus, Dufts.). Boar's Hill (*W. H.*).
Stomis pumicatus, Payk. In damp places, not rare; Cherwell banks, Tubney, Wytham Park, Yarnton, &c.
*Platyderus ruficollis, Marsh. Taken by Mr. W. Holland under stones in the grounds of the University Museum.
Pterostichus cupreus, L. Generally common on paths, in flood-refuse, &c.

P. versicolor, Sturm. With the preceding, but less common; Cherwell banks, Godstow, Wytham Park, Yarnton, &c.

***P. dimidiatus, Ol.** "Taken at Oxford, 1819" (*F. W. H.*).

***P. lepidus, F.** Tubney, in sandpit, rare (*W. H.*).

P. madidus, F. Under stones, on pathways, &c.; very common.

***P. oblongopunctatus, F.** Under dead leaves, chips, and in decayed wood; Bagley and Hen Woods, not rare at times; Marston (*J. W. S.*). "Taken at Bagley, Oxfordshire, in 1819-20 at the roots of Oaks" (*F. W. H.*). [No part of Bagley is in Oxfordshire.]

P. niger, Schall. On river bank at Marston (*J. W. S.*).

P. vulgaris, L. Under stones, &c.; common everywhere.

***P. anthracinus, Ill.** In wet place near Wytham Park, rare.

P. nigrita, F. In wet places, not rare and widely distributed.

P. minor, Gyll. In damp tufts of grass, &c.; Yarnton, not rare.

P. strenuus, Panz. } These two species are generally common in damp
P. diligens, Sturm. } places, flood-refuse, &c.

***P. picimanus, Dufts.** Bagley (*W. H.*); Cowley (*J. W. S.*).

***P. inæqualis, Marsh.** In flood-refuse and under stones; Water Eaton; Tubney (*W. H.*).

P. vernalis, Panz. In damp places; generally common.

P. striola, F. Under logs, &c., in woods; not rare, Bagley Wood, Wytham Park, &c. "Taken at the roots of trees at Bagley Wood' (*F. W. H.*).

Amara fulva, De G. In sandy places; Tubney, sometimes common.

A. apricaria, Payk. With the preceding; Tubney, &c., not rare.

***A. consularis, Dufts.** Under stones, &c., in sandy places; Cothill, Ogley Bog near Cowley, Tubney (common), &c.

A. aulica, Panz. On pathways, flower-heads, and under stones; Elsfield, Tubney, &c., occasional.

****A. patricia, Dufts.** Under stones in sandy places, rare; Tubney (*W. H.*).

A. bifrons, Gyll. In sandy places; Boar's Hill and Tubney, not rare; also in University Museum grounds.

A. ovata, F. In tufts and flood-rubbish, not common; Water Eaton; Oxford (*J. W. S.*).

A. similata, Gyll. More common than the preceding; Cherwell banks, Cumnor, &c.

***A. acuminata, Payk.** On paths in autumn, rare; Banbury Road.

A. tibialis, Payk. In sandy places; Tubney, plentiful.

A. lunicollis, Schiödte. On pathways, rare; Wytham.

A. familiaris, Dufts. On pathways and under stones; generally common.

****A. anthobia, Villa.** One example of this recent addition to the British list taken by Mr. Holland at Ogley Bog, June 1st, 1903.

A. trivialis, Gyll. On pathways, &c.; common everywhere.

A. communis, Panz. Chiefly in flood-refuse; Cherwell banks, Ogley Bog, Yarnton, &c., not rare.

A. continua, Steph. With the preceding, also under bark; Yarnton, not rare.

A. plebeia, Gyll. In flood-refuse; Yarnton, &c., rare.

Calathus cisteloides, Panz. Under stones and herbage; generally common.

C. fuscus, F. In sandy places under stones; Tubney, not rare.

C. flavipes, Fourc. With the preceding; Tubney, frequent.

C. melanocephalus, L. Under stones, &c.; common everywhere.

Amphigynus piceus, Marsh. Chiefly under dead leaves, &c.; Tubney, not rare.

Taphria nivalis, Panz. In sandy places, occasional; Boar's Hill; Tubney (*W. H.*).

Pristonychus terricola, Hbst. Under stones, dead leaves, &c., in sandy places; Cumnor, Tubney, &c.; not rare.

***Sphodrus leucophthalmus, L.** In cellar in Oxford (*J. W. S.*). "Found in October in Oxfordshire about houses. Taken in Feb. 1821" (*F. W. H.*).

Anchomenus angusticollis, F. Under bark, &c., Yarnton; Oxford (*J. W. S.*).

A. dorsalis, Müll. Under stones, at roots of trees, &c.; common.

A. albipes, F. In very wet places, flood-refuse, &c.; generally common.

A. oblongus, F. In flood-refuse, damp tufts, &c.; King's Weir, &c., not rare.

****A. livens, Gyll.** In wet places, rare; King's Weir (*Lambert*); Cherwell banks (*J. W. S.*).

A. marginatus, L. Under stones in damp places; Port Meadow, &c., not rare.

****A. sexpunctatus, L.** "On river banks" (*J. W. S.*).

A. parumpunctatus, F. In tufts of grass in damp places; generally common.

***A. atratus, Dufts.** In wet tufts, flood-refuse, &c.; Yarnton, not rare.

A. viduus, Panz. In damp places, not rare; Cherwell banks, King's Weir, Yarnton, &c. Var. **mœstus, Dufts.**, equally common with the type.

***A. versutus, Gyll.** Not common; King's Weir (*W. H.*).

A. micans, Nic. In wet places; Yarnton, &c. "River banks" (*J. W. S.*).

A. fuliginosus, Panz.
A. gracilis, Gyll.
A. piceus, L.
All these occur more or less commonly at Yarnton, King's Weir, &c., in moss, tufts of grass, &c., in wet places.

***A. thoreyi, Dej.** Cherwell banks (*J. W. S.*).

***A. puellus, Dej.** "River banks" (*J. W. S.*). Christchurch Meadow (*Holme*).

Olisthopus rotundatus, Payk. Under stones, &c., not rare; Boar's Hill, Cumnor, &c.

Bembidium rufescens, Guér. Under bark and in flood-refuse; Water Eaton and near Wytham Park; not rare.

***B. quinquestriatum, Gyll.** "Oxford" (*J. W. S.*).

B. obtusum, Sturm. In wet places, flood-refuse, &c.; common.

B. guttula, F. In damp places, flood-refuse, &c.; common.

B. biguttatum, Sahlb. With the preceding, not rare; Cherwell banks, Yarnton, &c.

B. æneum, Germ. In flood-refuse, sometimes flying, scarce; Water Eaton, Marston, &c.

B. assimile, Gyll. In damp places, flood-refuse, &c.; generally common.

***B. clarki, Daws.** "Otmoor" (*J. W. S.*).

B. articulatum, Panz. Muddy banks of ponds, Tubney, &c.; not rare.

B. minimum, F. In tufts and flood-refuse; generally distributed, and sometimes in great profusion.

***B. gilvipes, Sturm.** "Otmoor" (*J. W. S.*).

B. lampros, Herbst. In dry places, generally common. "Capt. Oxford, 1819" (*F. W. H.*).

B. tibiale, Dufts. Cowley (*J. W. S.*).

B. atrocæruleum, Steph. Cowley (*J. W. S.*).

B. decorum, Panz. "Oxford" (*J. W. S.*).

B. quadriguttatum, F. In muddy places; Marston, &c., not rare.

B. quadrimaculatum, L. With the preceding; Marston, &c., occasional.

***B. lunatum, Dufts.** Mesopotamia (*J. W. S.*).

B. femoratum, Sturm. In damp sandy places; generally distributed and not rare.

*B. **saxatile, Gyll.** "Oxford" (*J. W. S.*).
B. littorale, Ol. In flood-rubbish, tufts, &c.; occasional. "Captd., Oxford, 1819, and perhaps the most common of the genus, taken at the roots of grass" (*F. W. H.*).
B. punctulatum, Drap. Port Meadow (*J. W. S.*).
B. flammulatum, Clairv. In damp places, flood-refuse, &c., not rare; Port Meadow, Water Eaton, Yarnton, &c.
Tachypus flavipes, L. In dead leaves, &c., not common; Wytham Park; Cowley (*W. J. S.*). "Taken at Oxford, 1819" (*F. W. H.*).
***Trechus discus, F.** "Wheatley" (*J. W. S.*).
T. minutus, F. Under stones, dead leaves, &c., common. "Taken at Oxford, 1819" (*F. W. H.*).
T. obtusus, Er. With the preceding, scarce; Yarnton, &c.
Patrobus excavatus, Payk. Under logs, &c., not common; Wytham Park; Boar's Hill (*W. H.*); Bagley (*J. W. S.*).
[**Pogonus chalceus, Marsh.** "Taken at Oxford in 1820" (*F. W. H.*). I much doubt the occurrence of this strictly maritime species so far inland.]
***Lebia chlorocephala, Hoff.** In tufts of grass and under willow-bark, not rare in winter; Bagley Wood, Boar's Hill, Ogley Bog, Shotover, &c.
Demetrias atricapillus, L. In tufts of grass, &c.; generally common.
Dromius linearis, Ol. With the preceding, common. "Took one at Oxford in 1819. I took this species in December in incredible numbers in 1821" (*F. W. H.*).
***D. agilis, F.** Chiefly under loose bark; Bagley Wood, not rare.
D. meridionalis, Dej. Under bark, &c.; generally common.
D. quadrimaculatus, L. Under bark, &c., not rare; Bagley Wood, Wytham Park, &c.
D. quadrinotatus, Panz. With the preceding; generally common.
D. melanocephalus, Dej. In tufts of grass, among dead sticks, &c., common.
Blechrus maurus, Sturm. In tufts, under bark, &c., not rare; Wytham, Yarnton, &c.
Metabletus foveola, Gyll. In tufts, flood-rubbish, &c.; not rare and generally distributed.
M. truncatellus, L. With the preceding; Wytham Park, &c., fairly common.
Brachinus crepitans, L. Cowley (*J. W. S.*).

FAMILY **Haliplidæ.**

***Haliplus confinis, Steph.** In ponds and stagnant water; Tubney, Yarnton, &c., common. The var. **pallens**, Fowler, has been taken at Yarnton.
H. flavicollis, Sturm. In the Cherwell, near Summertown; occasional.
H. variegatus, Sturm. In stagnant water; Yarnton, &c., not rare.
***H. cinereus, Aubé.** In wet refuse on bank of pond, Cothill, scarce.
H. ruficollis, De G. In stagnant and running water; generally common.
H. fluviatilis, Aubé. In ditches; King's Weir and Binsey (*W. H.*).
H. lineatocollis, Marsh. In ditches, &c., generally common.

FAMILY **Dytiscidæ.**

Noterus sparsus, Marsh. In water among weeds; generally common.
Laccophilus obscurus, Panz. With the preceding, common.
Hyphydrus ovatus, L. In standing and running water, not rare "Taken in the Cherwell river at Oxford in 1819" (*F. W. H.*).

Cœlambus versicolor, Schall. In standing and running water; Cherwell at Summertown, Tubney, &c., not rare.

C. inæqualis, F. In ponds; Tubney, occasional. "Taken at Oxford in 1819" (*F. W. H.*).

C. confluens, F. In ditches, Marston (*W. H.*).

C. impressopunctatus, Schall. "Taken at Oxford, in 1822, by Cleeve of Exeter, on the Botley road" (*F. W. H.*) Not yet met with by me.

Deronectes depressus, F. "Taken in brooks in Oxfordshire" (*F. W. H.*).

D. 12-pustulatus, F. "Capt. Oxon, 1819" (*F. W. H.*).

Hydroporus pictus, F. In stagnant water; Islip, Marston; not rare. "Taken at Oxford in 1819" (*F. W. H.*).

H. granularis, L. In stagnant water in spring; Yarnton, common.

H. lepidus, Ol. In ponds, &c.; Boar's Hill; Bagley Wood, common (*W. H.*).

H. dorsalis, F. In stagnant water; Yarnton; Marston (*W. H.*); occasional.

H. lineatus, F. In standing water; generally common.

H. palustris, L. In standing and running water; generally abundant.

H. erythrocephalus, L. With the preceding; fairly common.

H. memnonius, Nic. Occasionally taken by sweeping in damp places; Bagley Wood.

***H. obscurus, Sturm.** In ponds at Tubney (*W. H.*).

H. pubescens, Gyll. In standing water; generally distributed.

H. planus, F. In standing water; not rare and widely distributed.

H. lituratus, F. With the preceding; Bagley Wood and near Wood Eaton (*W. H.*).

Agabus paludosus, F. "Taken at Oxford in 1820, in ditches" (*F. W. H.*).

A. didymus, Ol. In running water, scarce; Shotover, Yarnton; Binsey, Tubney (*W. H.*).

A. nebulosus, Forst. In ponds, not rare; Shotover, Tubney, Yarnton.

A. femoralis, Payk. In ditches near Marston (*W. H.*).

A. sturmi, Gyll. In ponds at Tubney; not rare.

A. chalconotus, Panz. With the preceding; not rare.

A. bipustulatus, L. In ponds and ditches; generally common.

Platambus maculatus, L. Chiefly in running water; Cherwell near Marston; near Islip, and Bagley Wood (*W. H.*). "Taken in the river Cherwell at Oxford very commonly in 1819" (*F. W. H.*)

Ilybius fuliginosus, F. In standing water; Marston; Cowley (*W. H.*), not rare.

***I. fenestratus, F.** In standing water at Tubney, and flying at Marston; "Taken at Oxford in 1819" (*F. W. H.*).

I. ater, De G. In standing water, not rare; Marston, Tubney, &c.

I. obscurus, Marsh. With the preceding, occasional; Marston, Yarnton.

Copelatus agilis, F. In standing water, not rare; Yarnton; Wytham (*W. H.*).

Rhantus exoletus, Forst. In standing water; Marston; Tubney (*W. H.*).

R. pulverosus, Steph. In ponds at Tubney (*W. H.*).

Colymbetes fuscus, L. In standing water; common.

Dytiscus punctulatus, F. In ditches; Marston, and near Wytham (*W. H.*). I have picked up this species in Oxford on the Banbury Road.

D. marginalis, L. In ponds and ditches; generally common.

Acilius sulcatus, L. With the preceding, not rare.

FAMILY **Gyrinidæ.**

Gyrinus natator, Scop.
G. opacus, Sahlb. } These two species are to be seen everywhere in summer on the surface of standing or running water, the latter being the commoner of the two.

FAMILY **Hydrophilidæ.**

Hydrobius fuscipes, L. In standing water; common. The var.? **picicrus,** Thoms., by some Coleopterists regarded as a distinct species, is common at Yarnton, Wytham Park, &c.

Philydrus testaceus, F. In standing water; Yarnton, &c., common.

P. nigricans, Zett. With the preceding, not rare; Yarnton, &c.

P. coarctatus, Gred. Occurs not rarely with the two preceding species.

Cymbiodyta ovalis, Th. In standing water; Tubney, Yarnton, &c., not rare.

Anacæna globulus, Payk.
A. limbata, F. } Both these are common in ponds, ditches, &c., and are also found among wet dead leaves.

Helochares punctatus, Sharp. In ponds; Tubney (*W. H.*).

Laccobius sinuatus, Mots.
L. minutus, L.
L. bipunctatus, F. } These three species are pretty generally common in standing and running water; Cherwell at Summertown, Tubney, &c.

Berosus luridus, L.
B. affinis, Brullé. } In shallow stagnant ponds at Yarnton; not uncommon.

Limnebius truncatellus, Thunb. In standing water, wet moss, &c.; Yarnton, not rare.

L. papposus, Muls. With the preceding, but much less common.

Chætarthria seminulum, Payk. In wet tufts, flood-refuse, &c.; Marston, Tubney, Yarnton, &c., not rare.

Helophorus rugosus, Ol. In dry places; sometimes by sweeping; Tubney, occasional.

H. nubilus, F. On walls and by sweeping; Cothill, Tubney, Wytham Park, &c.; not uncommon.

H. aquaticus, L. In standing water, occasionally flying; generally not rare.

H. æneipennis, Th. In standing water; not uncommon.

H. affinis, Marsh. In standing water, on wet mud, &c.; very common.

H. brevipalpis, Bedel.
H. brevicollis, Th. } Taken at King's Weir (*W. H.*).

***H. nanus, Sturm.** In the Cherwell at Marston; rare.

Ochthebius pygmæus, F. In wet moss, standing water, &c.; Tubney, not rare.

O. bicolon, Germ. In shallow ponds in spring; Yarnton, common.

Hydræna riparia, Kug. In running water, flood-refuse, &c.; Marston, Yarnton, not common. "Taken at Oxford not far from Port Meadow in May, 1822" (*F. W. H.*).

Cyclonotum orbiculare, F. In wet places, flood-refuse, &c.; generally common.

Sphæridium scarabæoides, L.
S. bipustulatum, F. } Both these species are found very commonly in fresh cow-dung, and sometimes on the wing.

Cercyon hæmorrhous, Gyll. In dung, &c.; Tubney; King's Weir (*W. H.*).

C. hæmorrhoidalis, F. In dung, vegetable refuse, &c.; not rare.

***C. obsoletus, Gyll.** Tubney (*W. H.*).

C. flavipes, F. In dung, &c ; generally common.
C. lateralis, Marsh. In dung, &c. ; Boar's Hill (*W. H.*).
C. melanocephalus, L.
C. unipunctatus, L.
C. quisquilius, L. } All these are more or less common in dung flood-refuse, &c., and sometimes by sweeping.
C. nigriceps, Marsh. Boar's Hill (*W. H.*).
C. pygmæus, Ill. In dung; generally common.
C. lugubris, Payk. Ferry Hinksey (*W. H.*).
Megasternum boletophagum, Marsh. In flood-refuse, dung, decayed fungi, &c. ; often very abundant.
Cryptopleurum atomarium, Ol. Chiefly in vegetable refuse ; generally common.

FAMILY **Staphylinidæ.**

Aleochara fuscipes, F. In dead animals and birds ; generally common.
***A. lata, Grav.** In dead rabbits ; Wytham Park, not common.
***A. brevipennis, Grav.** In wet tufts of grass ; Yarnton, rare.
***A. tristis, Grav.** In dung, scarce ; Wytham Park ; Boar's Hill (*W. H.*), Water Eaton (*J. C.*).
A. bipunctata, Ol. In dung, occasional ; Water Eaton (*J. C.*).
***A. cuniculorum, Kr.** In and about rabbit-burrows ; Boar's Hill ; Tubney, in abundance, May, 1905.
A. lanuginosa, Gr. In dung, vegetable refuse, and by sweeping ; common.
A. succicola, Th. In vegetable refuse, &c. ; generally common.
****A. mœrens, Gyll.** One specimen found on my own doorstep at Summertown, 20th October, 1906.
A. nitida, Gr. In small carcases and by sweeping ; not rare.
A. morion, Gr. Occasionally by sweeping ; Tubney, Wytham Park, &c.
Microglossa suturalis, Sahlb. In vegetable refuse ; Marston, &c., not rare.
***M. pulla, Gyll.** In fungi on old elms ; Tubney, rare.
M. nidicola, Fairm. In and about sand-martins' nests in sandpits ; Cumnor and Tubney, common.
Oxypoda lividipennis, Mann. In dead leaves and by sweeping ; Bagley Wood, Wytham Park, &c. ; occasional.
O. vittata, Märk. By sweeping ; Wytham Park, rare, November, 1906.
O. opaca, Gr. In wet tufts and marshy places ; Wytham Park, Yarnton, &c., not rare.
O. alternans, Gr. In decaying fungi ; Wytham Park, &c., sometimes common.
O. longiuscula, Gr. In moss, tufts of grass, &c. ; Yarnton, not rare.
***O. brachyptera, Steph.** In sandpit at Cumnor, rare, June, 1906.
***Ocyusa maura, Er.** In damp moss ; Yarnton, common in moss in spring ; Grandpont (*W. H.*).
****Phlœopora corticalis, Gr.** One in fungus on elm near Water Eaton, September, 1905 (*G. C. Champion*).
Ocalea badia, Ex. In vegetable refuse, cut grass, &c. ; Bagley, Shotover, Tubney, Wytham Park, &c. ; not rare.
****Calodera riparia, Er.** In damp tufts of grass at Yarnton ; early spring, rare.
***C. æthiops, Gr.** With the preceding ; not uncommon.
***Myrmedonia collaris, Payk.** In tufts of grass, spring ; Boar's Hill, Yarnton, rare.
M. limbata, Payk. Under stones with *Formica flava* ; occasionally by sweeping ; Chilswell Hills, Elsfield, Wytham Park ; scarce.
Drusilla canaliculata, Fab. Under stones and among grass, usually with ants ; generally common.

*__Callicerus obscurus, Gr.__ In damp tufts and by sweeping, chiefly in spring; Cothill, Tubney, Yarnton; not rare.

*__C. rigidicornis, Er.__ In sandpit, Tubney, rare (*W. H.*).

Thamiaræa hospita, Märk. In exuding sap of Cossus-infested oak, near Summertown, scarce.

Alianta incana, Er. In débris of bulrushes (Typha); Cothill, Shotover; scarce.

**__Homalota languida, Er.__ In damp moss at Yarnton; rare, spring.

*__H. insecta, Th.__ With the preceding, rare.

H. gregaria, Er. In damp vegetable refuse; generally common.

H. luridipennis, Mann. In damp tufts of grass; Yarnton, occasional.

H. vicina, Steph. In damp places; widely distributed and not rare.

H. graminicola, Gr. In damp places; Cherwell at Summertown, Yarnton, &c., common.

H. æquata, Er. Under bark at Wytham Park; occasional.

*__H. angustula, Gyll.__ In sandpits, tufts of grass, &c.; Cumnor, Yarnton, scarce.

*__H. cæsula, Er.__ This usually maritime species has occurred rarely under herbage in sandy places near Tubney, October, 1905.

H. circellaris, Gr. In damp places; generally common.

**__H. splendens, Kr.__ One example of this very rare and distinct species taken in a sandpit on Cumnor Hill, 28th May, 1906 (*G. C. Champion*).

H. immersa, Er.
H. cuspidata, Er. } These two species are found sparingly at Wytham Park, under bark of small decayed boughs of oak, &c.

H. analis, Gr. In flood and vegetable refuse, by sweeping, &c.; very common.

H. depressa, Gyll. By sweeping, and on the wing; common in early summer.

H. æneicollis, Sharp. At entrance of rabbit-burrows; Hen Wood, scarce.

H. xanthoptera, Steph. In vegetable refuse, &c.; generally common.

H. euryptera, Steph. At exuding sap of elm; Godstow, rare.

H. trinotata, Kr. In vegetable refuse; generally common.

H. fungicola, Th. In fungi in autumn; not rare.

H. liturata, Steph. In dry fungi on elms; Wytham Park, not rare.

**__H. clancula, Er.__ One or two examples of this rare species have occurred in moss at Yarnton.

H. divisa, Märk. At entrance of rabbit-burrows; Tubney, occasional.

*__H. scapularis, Sahlb.__ By evening sweeping in woody places; Elsfield, Tubney, Wytham Park, &c.; occasional.

**__H. dilaticornis, Kr.__ One specimen of this very rare species taken by evening sweeping near Elsfield, 25th June, 1905.

H. macrocera, Th. Ferry Hinksey (*W. H.*).

H. atramentaria, Gyll. In dung, &c.; generally common.

H. fungi, Gr. In vegetable refuse, by sweeping, &c.; very common. Many more species of *Homalota* are sure to be added to the local list when this difficult genus is more closely worked up.

Gnypeta labilis, Er. Chiefly on wet mud; Cothill, Port Meadow, Yarnton, &c., common.

Tachyusa atra, Gr. In damp places, flood-refuse, &c.; Ogley Bog, Yarnton, &c., occasional.

Falagria sulcata, Payk. In vegetable refuse; generally common.

*__F. sulcatula, Gr.__ With the preceding; Summertown, occasional.

F. obscura, Gr. In damp rubbish; not rare and widely distributed.

Autalia impressa, Ol. In decaying fungi; Bagley Wood, Tubney, Wytham Park, &c.; not rare.

A. rivularis, Gr. In vegetable refuse ; not uncommon.
***Encephalus complicans, Westw.** This curious little species is found in damp tufts of grass, and sometimes by sweeping, but not commonly; Cothill, Ogley Bog, Tubney, &c.
Gyrophæna nana, Payk. In fungi, Wytham Park, &c. ; occasional.
G. fasciata, Marsh. In fungi, not rare ; Wytham Park ; Boar's Hill (*W. H.*).
***G. manca, Er.** In fungi ; Wytham Park, rare.
***G. strictula, Er.** In hard fungus on stump, Cothill ; abundant, April, 1905.
Agaricochara lævicollis, Kr. Among decayed faggots ; Bagley Wood, rare.
Epipeda plana, Gyll. Under loose bark ; Bagley Wood, Wytham Park, &c., not rare.
***Silusa rubiginosa, Er.** At exuding sap of elm ; Godstow, one example.
Leptusa fumida, Er. Under loose bark ; Wytham Park, not rare.
***Bolitochara lucida, Gr.** In faggots, fungi, &c. ; Bagley Wood, Wytham Park ; not rare.
***B. bella, Märk.** With the preceding, but rather more common.
***Hygronoma dimidiata, Gr.** In very wet places ; Cherwell banks, Ogley Bog, Yarnton, &c. ; not uncommon.
Oligota pusillima, Gr. In tufts, &c. ; Tubney, occasional.
Myllæna gracilis, Matt. In very wet places ; Tubney ; Grandpont (*W. H.*).
***Deinopsis erosa, Steph.** In tufts of grass on river-bank ; King's Weir, scarce.
Hypocyptus longicornis, Payk. In vegetable refuse and by sweeping ; abundant.
***H. seminulum, Er.** By evening sweeping in summer ; Wytham Park, not rare.
Conosoma littoreum, L. Among dead sticks, in faggots, &c. ; Bagley Wood, Marston, Tubney, Wytham Park, &c. ; not rare.
C. pubescens, Gr. In vegetable refuse, &c. ; generally common.
***C. immaculatum, Steph.** In vegetable refuse ; Tubney, rare.
***C. pedicularium, Gr.** In tufts of grass in damp places, spring ; Yarnton, common, Godstow, &c.
C. lividum, Er. In vegetable refuse, &c. ; generally distributed.
Tachyporus obtusus, L. In moss, dead leaves, &c., and by sweeping ; common.
****T. formosus, Grav.** By sweeping ; Tubney, Wytham Park ; occasional.
***T. pallidus, Sharp.** In wet places ; Cothill, Tubney, Yarnton, &c. ; common.
T. chrysomelinus, L.
T. humerosus, Er.
T. hypnorum, F.
T. pusillus, Gr.
T. brunneus, F.
} All these species are common throughout the district, in moss, tufts of grass, and vegetable refuse generally.
****Lamprinus saginatus, Gr.** In tufts of grass with the ant *Myrmica rubra*, and under stones with *Formica flava* ; Tubney, rare, spring 1905 and 1906.
Cilea silphoides, L. In dung and on walls ; generally distributed.
Tachinus humeralis, Gr. In vegetable refuse, decaying fungi, &c. ; not rare.
T. rufipes, De G. In vegetable refuse, by sweeping, &c. ; common.
T. subterraneus, L. In vegetable refuse, &c. ; fairly common.
T. marginellus, F. In vegetable refuse ; often by sweeping ; common.
T. laticollis, Gr. In tufts of grass ; Yarnton, rare.
****T. elongatus, Gyll.** One specimen in moss at Boar's Hill (*W. H.*).

**Megacronus cingulatus, Mann. By sweeping at Wytham Park; one, April 13th, 1906.
M. analis, Payk. By sweeping; Ogley Bog, Wytham Park, &c., scarce.
**M. inclinans, Gr. One example at Hen Wood (*W. H.*).
Bolitobius lunulatus, L.
B. trinotatus, Er.
B. exoletus, Er.
B. pygmæus, F.
} All more or less common in fresh as well as in decayed fungi in woody places.
Mycetoporus splendens, Marsh. By sweeping and in sandpits; not rare, spring.
**M. punctus, Gyll. Near Cumnor; one example by sweeping, 31st May, 1906.
M. lepidus, Gr.
M. longulus, Mann.
} Not rare on walls, in sandpits, and by sweeping, throughout the district.
M. splendidus, Gr. In wet places; Wytham Park, Yarnton, &c., not rare.
Habrocerus capillaricornis, Gr. Among dead sticks, &c.; Bagley Wood, Wytham Park, &c.; not uncommon.
Heterothops dissimilis, Gr. In flood-refuse, &c.; Yarnton, not common.
*H. nigra, Kr. In flood-refuse, Yarnton, rare. The natural habitat of this species is in the nest of the mole, in which it has been taken by Dr. N. H. Joy plentifully in Berkshire and elsewhere.
*Quedius lateralis, Gr. In fungi and cut-grass; Wytham Park, not common.
Q. mesomelinus, Marsh. Bagley Wood, by beating hawthorn-blossom, June, 1904.
*Q. puncticollis, Th. By sweeping at Wytham Park; one example, 3rd November, 1906.
**Q. brevicornis, Th. One dead but perfect specimen in fungus at Besselsleigh, 6th October, 1906. An inhabitant of birds' nests in hollow trees.
Q. cruentus, Ol. Under loose bark; Bagley Wood, Wytham Park; scarce.
Q. cinctus, Payk. In dead leaves, vegetable refuse, &c.; generally common.
Q. fuliginosus, Gr. Chiefly in damp places; not uncommon.
Q. tristis, Gr. Under stones, in tufts, &c., not uncommon.
Q. molochinus, Gr. With the preceding, but more plentiful.
Q. picipes, Mann. Among dead leaves, sticks, &c.; not rare.
*Q. nigriceps, Kr. Among dead leaves, in moss, &c.; Hen Wood, Tubney; scarce.
*Q. fumatus, Steph. Among dead leaves, vegetable refuse, &c.; Elsfield, Tubney, Wytham Park, &c.; not uncommon.
Q. maurorufus, Gr. In wet tufts of grass, &c.; Elsfield, Yarnton, &c., not rare.
Q. obliteratus, Er. In vegetable refuse near Port Meadow, rare.
Q. rufipes, Gr. On walls, among vegetable refuse, &c; common.
Q. attenuatus, Gyll. Chilswell (*W. H.*).
Q. boöps, Gr. Chiefly by sweeping; generally common.
Creophilus maxillosus, L. In carrion and on the wing; common.
Leistotrophus nebulosus, F. In dung; Boar's Hill (*W. H.*); Water Eaton (*J. C.*).
L. murinus, L. In dung, tufts, &c., Elsfield, Tubney, &c., not rare.
*Staphylinus pubescens, De G. Bagley Wood (*W. H.*).
*S. stercorarius, Ol. Occasionally on the wing (*W. H.*).
**S. latebricola, Gr. Ferry Hinksey, rare (*W. H.*).
*S. erythropterus, L. Bagley Wood and Tubney, occasional (*W. H.*).
S. cæsareus, Ceder. Occasionally on the wing and on paths.

Ocypus olens, Müll. In gardens, under stones, &c.; common, especially in autumn.
***O. fuscatus, Gr.** "Christ Church Meadow" (*F. Holme*).
O. cupreus, Rossi. Under stones, in moss, &c.; Tubney, &c., scarce.
***O. ater, Gr.** Summertown, Wytham Park, &c.; occasionally under stones.
O. morio, Gr. Under stones, &c.; Tubney (small form), Wytham Park; not rare.
O. compressus, Marsh. Cumnor and Tubney (*W. H.*).
Philonthus splendens, F. In dead animals, not common; Wytham Park.
P. intermedius, Bdv. In moss, tufts of grass, &c.; sparingly distributed.
P. laminatus, Creutz. Chiefly in tufts of grass; not rare.
P. æneus, Rossi. In dung, dead animals, &c.; generally common.
P. proximus, Kr. In putrid fungi, &c.; Tubney, Wytham; scarce.
P. carbonarius, Gyll. In wet tufts, occasionally on pathways; not rare; Summertown, Wytham, Yarnton, &c.
***P. decorus, Gr.** Bagley Wood, among dead leaves (*W. H.*).
****P. lucens, Er.** This rare species has occurred at Bagley Wood and Boar's Hill (*W. H.*).
P. politus, F. In moss, tufts, and on pathways; generally common.
P. varius, Gyll. On walls, among vegetable rubbish, &c.; common.
P. marginatus, F. Chiefly in dung; common and generally distributed.
P. fimetarius, Gr. In vegetable rubbish, tufts of grass, &c.; not rare.
P. sordidus, Gr. With the preceding; not rare.
P. ebeninus, Gr. In vegetable refuse, &c.; sparingly but widely distributed.
P. fumigatus, Er. Taken at Boar's Hill (*W. H.*).
P. debilis, Gr. In wet tufts of grass: Yarnton, Kennington, &c.; scarce.
P. sanguinolentus, Gr. In dung, on pathways, &c.; generally common.
P. cruentatus, Gmel. With the preceding; fairly common.
P. varians, Payk. In dung, &c.; frequent.
P. discoideus, Grav. In manure-heaps; Summertown, occasional.
P. quisquiliarius, Gyll. In wet muddy places; generally common.
***P. fumarius, Gr.** In vegetable refuse, scarce; Yarnton.
P. micans, Gr. In moss, tufts, &c.; not rare.
P. trossulus, Nor. In damp places, common; often swarming in flood-rubbish.
***P. puella, Nor.** In dung, scarce; Boar's Hill and Water Eaton (*J. C.*).
***Actobius cinerascens, Gr.** In wet tufts of grass, not common; Wytham, Yarnton.
***A. procerulus, Gr.** Tubney (*W. H.*).
Xantholinus glabratus, Gr. On walls and pathways, chiefly in autumn; common.
X. punctulatus, Payk. In vegetable refuse, on walls, &c.; common.
X. ochraceus, Gyll. With the preceding, not rare.
***X. tricolor, F.** Under stones in sandy places, local and scarce; Tubney.
X. linearis, Ol. In vegetable refuse, on walls, in sandpits, &c.; not rare.
X. longiventris, Heer. With the preceding, fairly common.
Leptacinus linearis, Gr. In manure-heaps, damp places, &c.; Summertown.
Baptolinus alternans, Kr. Under bark, among dead sticks, &c.; Bagley Wood, Wytham Park; sparingly.
Othius fulvipennis, F. Among dead leaves, in tufts, &c.; widely distributed.
O. læviusculus, Steph. In vegetable refuse and by sweeping; generally common.

O. melanocephalus, Gr. In damp places, sandpits, &c.; Shotover, Tubney, not rare.

O. myrmecophilus, Kies. Tubney (*W. H.*).

Lathrobium elongatum, L.
L. boreale, Hoch.
L. fulvipenne, Gr.
These three species occur plentifully in wet tufts of grass in winter and early spring at King's Weir, Yarnton, and other marshy places.

***L. angustatum, Lac.** One taken in tuft of grass near Wytham, spring, 1905 (*J. C.*).

L. brunnipes, F. In wet tufts of grass; generally common.

***L. longulum, Gr.** In wet places; Bagley Wood, King's Weir, Wytham, Yarnton, &c.: not rare.

***L. fovulum, Steph.** In wet places and under willow bark; King's Weir; Water Eaton (*J. C.*).

***L. filiforme, Gr.** This usually rare species is found commonly in wet tufts and flood-rubbish in winter at Summertown, Wytham, Yarnton, &c.

***L. quadratum, Payk.** In damp tufts, rather scarce; King's Weir, Wytham, Yarnton.

L. terminatum, Gr. In moss, tufts of grass, &c.; Yarnton, not rare.

L. multipunctum, Gr. Under stones; Wytham Park, not common.

***Achenium depressum, Gr.** In flood-refuse, &c.; Cherwell banks, sparingly.

***A. humile, Nic.** In tufts of grass, &c., rare; Islip; King's Weir and Water Eaton (*J. C.*).

Cryptobium glaberrimum, Hbst. In wet places, not rare; Bagley Wood, Tubney, Yarnton, &c.

Stilicus rufipes, Germ. In tufts and vegetable refuse; generally common.

***S. orbiculatus, Payk.** In damp tufts of grass, not rare; Ogley Bog, Shotover, Tubney, Yarnton, &c.

S. affinis, Er. In vegetable refuse; common everywhere.

****Medon castaneus, Grav.** Single specimens of this fine and very rare species have been taken by me at Boar's Hill, under a stone, April 22nd, and in a sandpit at Tubney, April 29th, 1905. Mr. Holland also took one in the last-mentioned locality, May 4th, 1902.

****M. dilutus, Er.** One example of this species, which is even rarer than the preceding, taken at Tubney by the late Mr. C. E. Collins of Reading, November 20th, 1899.

M. propinquus, Bris. In tufts, vegetable refuse, &c.; common.

Lithocharis ochracea, Gr. By sweeping at Wytham Park; occasional.

Pæderus littoralis, Gr. At roots of grass, under stones, &c.; generally common.

P. riparius, L. In moist places, grass-tufts, &c.; King's Weir, Yarnton; common.

Evæstethus ruficapillus, Lac. In damp moss, &c., at Yarnton; not rare.

Stenus bipunctatus, Er. South Hinksey (*W. H.*).

***S. guttula, Müll.** On damp mud and in flood-rubbish; Port Meadow, Water Eaton, scarce.

S. bimaculatus, Gyll. In damp tufts, vegetable refuse, &c.; common.

S. juno, F. In wet places, damp moss, &c.; generally plentiful.

****S. longitarsis, Th.** In wet tufts of grass; Yarnton, very rare.

S. speculator, Lac.
S. providus, Er. var. rogeri, Kr.
These two species occur frequently in rather dry places and by sweeping.

S. buphthalmus, Gr. In tufts, Yarnton; Bagley Wood (*W. H.*).

S. melanopus, Marsh. In wet places; Yarnton, &c., not rare.

*__S. atratulus, Er.__ In damp moss and tufts; Yarnton, sparingly.
S. pusillus, Er. With the preceding; fairly common.
*__S. fuscipes, Gr.__ In damp tufts of grass; King's Weir, Yarnton, &c.; sparingly.
*__S. circularis, Gr.__ In grass tufts, in autumn and winter, rare; Cothill and Yarnton.
S. declaratus, Er. In tufts, and sometimes by sweeping; fairly common.
S. brunnipes, Steph. Chiefly in vegetable refuse; very common.
S. subæneus, Er. South Hinksey (*W. H.*).
S. ossium, Steph. In wet tufts of grass, &c.; Boar's Hill, Yarnton; not rare.
S. impressus, Germ. In faggots and by sweeping; Wytham Park, sparingly.
S. erichsoni, Rye. By sweeping; Wytham Park, &c., sparingly.
S. pallipes, Gr. In wet places; sparingly but widely distributed.
S. flavipes, Steph. With the preceding, but much more plentiful.
S. pubescens, Steph. Chiefly on river-banks; Marston Ferry, Godstow, Yarnton, &c.; fairly common.
S. binotatus, Ljungh. Found rather sparingly with the preceding.
S. pallitarsis, Steph. On rushes, in tufts, &c., occasional; Marston, Yarnton; Botley (*W. H.*).
*__S. bifoveolatus, Gyll.__ In damp tufts; Yarnton, scarce.
S. cicindeloides, Gr. In damp tufts, moss, &c.; Yarnton, &c., fairly common.
S. similis, Herbst. In vegetable refuse, tufts, &c.; generally common.
S. tarsalis, Ljungh. In grass-tufts, flood-refuse, &c.; generally distributed and often very abundant.
*__Oxyporus rufus, L.__ This showy insect has occurred in fungi near Summertown (*J. C.*), and I have taken it by sweeping at Tubney.
Bledius opacus, Block. In sandy places; Cumnor, Cothill, Tubney; common, especially in spring.
Platystethus arenarius, Fourc. Generally distributed, and not rare in damp places.
P. cornutus, Gr. With the preceding; not uncommon.
**__P. nitens, Sahlb.__ By sweeping, and flying in early spring; Marston, Wolvercote; rare.
Oxytelus rugosus, F. In dung and vegetable refuse, very common. The var. **terrestris, Lac.** of occasional occurrence.
O. sculptus, Gr. With the preceding; common everywhere.
O. laqueatus, Marsh. Chiefly by sweeping; widely distributed and not rare.
O. sculpturatus, Gr. In dung, vegetable refuse, &c.; common.
O. nitidulus, Gr. In sandpits and on the wing; Tubney, &c., not rare.
O. complanatus, Er. With the preceding; Tubney, &c., fairly common.
O. tetracarinatus, Block. In dung, and flying; abundant, chiefly in spring.
Haploderus cœlatus, Gr. By sweeping, and on the wing; generally common.
Trogophlœus bilineatus, Steph. In wet places, tufts, &c.; Cherwell banks, King's Weir, Yarnton, &c., not rare.
T. pusillus, Gr. Generally common in wet places.
Coprophilus striatulus, F. In vegetable refuse, and on walls and pavements; common in early spring.
Lesteva longelytrata, Goeze. In wet places, moss, &c.; Cothill, Marston, Yarnton; not rare.
L. pubescens, Mann. Ferry Hinksey (*W. H.*).

L. sicula, Er. On river-banks and in wet places; Cothill, Marston, Yarnton, &c., not rare.

Olophrum piceum, Gyll. By sweeping, in sandpits, among dead leaves, &c.; common.

Lathrimæum atrocephalum, Gyll.
L. unicolor, Steph. } Both common among dead leaves and sticks; Bagley Wood, Boar's Hill, Wytham Park, &c.

***Deliphrum tectum, Payk.** In putrid fungus; one specimen, Wytham Park, October 25th, 1906.

Philorhinum sordidum, Steph. In flowers of broom, Cumnor Hill; common, May, 1906.

***Coryphium angusticolle, Steph.** In decaying faggots; Bagley Wood, not rare.

Homalium rivulare, Payk. In carrion and decaying fungi; very common.

****H. septentrionis, Thoms.** In fungi and by sweeping; Wytham Park, rare.

H. oxyacanthæ, Gr. Tubney (*W. H.*).

H. excavatum, Steph. In dead leaves, by sweeping, &c.; generally common.

H. cæsum, Gr. With the preceding, not rare. The well marked var. **tricolor, Rey,** occurs rarely by sweeping at Wytham Park.

H. rufipes, Fourc. Chiefly on hawthorn-blossom in spring; Bagley Wood, Tubney, Wytham Park, &c., not rare.

H. vile, Er. Under bark; Tubney, Wytham Park, &c., not rare.

H. iopterum, Steph. Chiefly under oak bark; Bagley Wood, Boar's Hill, Wytham Park, &c., not rare.

H. concinnum, Marsh.
***H. deplanatum, Gyll.** } These two species have been taken rather sparingly in dry tree fungi near Summertown and at Wytham Park.

H. striatum, Gr. In dung, and by sweeping; widely distributed and not rare.

***Hapalaræa pygmæa, Payk.** Once found at Summertown, on a window in my house.

Eusphalerum primulæ, Steph. In primroses in woods; Bagley Wood, Wytham Park, &c.; common in early spring.

***Anthobium minutum, F.** By sweeping in wet places, early summer; Cothill and Ogley Bog, common; Ferry Hinksey (*W. H.*).

A. ophthalmicum, Payk.
A. torquatum, Marsh. } Both plentiful in flowers, chiefly of *Umbelliferæ*, in early summer.

A. sorbi, Gyll. Bagley Wood (*W. H.*).

Proteinus ovalis, Steph. In vegetable refuse and on the wing; very common.

P. brachypterus, F. Tubney (*W. H.*).

P. atomarius, Er. In fungi at Wytham Park, rare.

Megarthrus denticollis, Beck.
M. depressus, Payk.
M. sinuatocollis, Lac. } All more or less common among vegetable refuse, dead leaves, &c., as well as on the wing.

***M. hemipterus, Ill.** In fungi at Wytham Park; rather rare.

Phlœobium clypeatum, Müll. In tufts of grass, vegetable refuse, &c.; common.

****Pseudopsis sulcata, Newm.** Recorded by Mr. F. Holme, Trans. Ent. Soc. vol. iii. p. 109, footnote (1840). "A second specimen of the *Pseudopsis* has been taken by Mr. Matthews at Shotover Hill, near Oxford." It should be looked for among vegetable refuse and at the bottoms of haystacks.

Prognatha quadricornis, Kirby. In decaying faggots, Bagley Wood, scarce; Boar's Hill (*W. H.*).

Family **Leptinidæ.**

*__Leptinus testaceus, Müll.__ In faggots, Bagley Wood, and in decayed ash tree, Wytham Park, singly in both instances.

Family **Clambidæ.**

Calyptomerus dubius, Marsh. In vegetable refuse, dead leaves, &c., Wytham Park, occasional.

Family **Silphidæ.**

*__Agathidium nigripenne, Kug.__ Under bark in spring; Wytham Park, not rare.

A. atrum, Payk. Tubney (*W. H.*).

A. lævigatum, Er. In vegetable refuse; Tubney, scarce.

*__A. varians, Beck.__ In dead sticks, old faggots, &c.; Bagley Wood, common.

*__A. convexum, Sharp.__ In dead leaves and sticks; Bagley Wood, Elsfield, Shotover, &c.; frequent.

*__A. rotundatum, Gyll.__ In dead sticks, &c.; Tubney, occasional.

A. nigrinum, Sturm. In old faggots, vegetable refuse, &c.; Bagley Wood, Elsfield; frequent.

*__Amphicyllis globus, F.__ In old faggots; Bagley Wood, rare.

Liodes humeralis, Kug. In dead sticks and by sweeping; Bagley Wood, Tubney, &c., frequent.

*__L. orbicularis, Herbst.__ By evening sweeping at Wytham Park; occasional.

*__Cyrtusa pauxilla, Schm.__ By evening sweeping in summer; Wytham Park, not rare.

**__Anisotoma cinnamomea, Panz.__ By evening sweeping in autumn; a fine series at Wytham Park, October and November, 1906, and singly at Summertown, September 21st, 1904.

*__A. dubia, Kug.__ By evening sweeping; Tubney, Wytham Park; scarce.

*__A. badia, Sturm.__ By evening sweeping; Bagley Wood, Marston; rare.

*__A. ovalis, Schm.__ By evening sweeping in summer; Wytham Park, occasional.

*__A. punctulata, Gyll.__ By evening sweeping, especially in autumn; Elsfield, Tubney, Wytham Park; not rare.

A. calcarata, Er. By evening sweeping in summer; fairly common.

**__A. nigrita, Schm.__ By evening sweeping at Wytham Park; rare.

**__A. triepkei, Schm.__ By evening sweeping in late summer; Tubney, rare, also singly at Boar's Hill.

**__A. rugosa, Steph.__ Single specimens of this rare species taken by evening sweeping under fir trees at Tubney, 22nd October, 1904, 20th and 27th October, 1906; and at Wytham Park, 3rd November, 1906.

*__A. parvula, Sahlb.__ By evening sweeping at Wytham Park; occasional.

Colenis dentipes, Gyll. By evening sweeping in summer; not rare and widely distributed.

**__Hydnobius punctatissimus, Steph.__ By evening sweeping in autumn, rare; Tubney (pale form), Wytham Park (black form).

*__H. strigosus, Schm.__ By evening sweeping in summer; Wytham Park, not rare; also at Water Eaton.

**__Necrophorus germanicus, L.__ "One of the rarest of all the British Coleoptera. It has been twice taken in Lord Abingdon's woods at Witham, on the bodies of dead game laid to ensnare Vermin—It was

taken in 1822 at the same place and sent to me, it was about the 6th of Augt." (*F. W. H.*). This large and very conspicuous beetle has not been taken in Britain for many years, and its name is expunged from the more modern lists of our Coleoptera.

N. humator, Goeze. In dead animals; fairly common.

N. mortuorum, F. In carrion and putrid fungi; Tubney, Wytham Park, &c., not rare.

***N. vestigator, Hers.** In dead rabbit at Boar's Hill, singly, 4th August, 1900.

N. ruspator, Er. In dead rabbits, &c.; Boar's Hill and Wytham Park, not rare.

N. vespillo, L. In carrion; not rare and generally distributed.

***Necrodes littoralis, L.** In carrion, occasional (*W. H.*).

***Silpha quadripunctata, L.** On oak trees in early summer, Bagley Wood, not rare (*W. H.*). "Taken on Oaks at Bagley Wood near Oxford in 1820 (*F. W. H.*).

***S. opaca, L.** South Hinksey (*W. H.*).

S. thoracica, L. In carrion, Tubney, &c.; occasional. "Taken in immense numbers in Lord Abingdon's Woods at Witham in 1818" (*F. W. H.*).

S. rugosa, L.
S. sinuata, F. } Both these are generally common in dead animals, especially the first-named.

S. lævigata, F. On paths and in sandpits; Cumnor, &c., not common.

S. atrata, L. In vegetable rubbish, under damp bark, &c.; generally common. The var. **brunnea, Herbst,** of occasional occurrence. "Taken in Shropshire and at Oxford" (*F. W. H.*).

***Choleva angustata, F.** Among dead leaves; Tubney, &c., rare.

C. cisteloides, Froh. In tufts, under stones, &c.; Ogley Bog, Yarnton, &c., scarce.

***C. intermedia, Kr.** On walls, Oxford, and among vegetable refuse in autumn, Elsfield, scarce.

C. agilis, Ill. In tufts of grass, vegetable refuse, &c.; not rare.

C. velox, Spence. With the preceding; Yarnton, &c., scarce

C. wilkinii, Spence. Among dead leaves and sticks; Bagley Wood, Boar's Hill, Tubney, &c., not rare.

***C. anisotomoides, Spence.** In wet tufts of grass; Ogley Bog, Tubney, Yarnton; not rare.

***C. nigricans, Spence.** Among dead leaves, &c.; Bagley Wood, Yarnton, scarce; Tubney (*W. H.*).

C. grandicollis, Er. In carrion, decaying fungi, &c.; Boar's Hill, Elsfield, Tubney, Wytham Park, &c., not rare.

***C. nigrita, Er.** Chiefly in damp tufts of grass; King's Weir, Water Eaton, Yarnton, occasional.

C. tristis, Panz.
C. kirbyi, Spence.
C. chrysomeloides, Panz.
C. fumata, Spence.
C. watsoni, Spence. } All these species occur more or less plentifully in dead animals. *C. chrysomeloides* being especially abundant at times.

Catops sericeus, Panz. In small dead animals; also by sweeping; generally common.

***C. sericatus, Chaud.** By sweeping and at roots of grass; Cothill, Tubney; scarce.

****Colon viennense, Herbst.** Single specimens of this rare species taken by sweeping at Tubney, October 20th, and at Wytham Park, October 22nd, 1906.

****C. serripes, Sahlb.** By evening sweeping; Ogley Bog and near Marston Ferry, rare.

****C. dentipes, Sahlb.** By sweeping; one fine male example, Tubney, October 27th, 1906.

***C. brunneum, Latr.** By evening sweeping in summer; Bagley Wood, Tubney, Wytham Park; occasional.

FAMILY Scydmænidæ.

***Neuraphes angulatus, Müll.** By sweeping at Tubney; rare.

****N. sparshalli, Denny.** Near Elsfield, by evening sweeping; one, July, 1905.

Scydmænus scutellaris, Müll. In vegetable refuse, tufts of grass, &c.; fairly common.

S. collaris, Müll. With the preceding; occasional.

***Euconnus denticornis, Müll.** By evening sweeping; Elsfield, Wytham Park; rare.

***E. hirticollis, Ill.** In damp tufts of grass; Yarnton, rare.

***E. fimetarius, Chaud.** In grass tufts on old manure-heap near Summertown; common, early spring, 1906.

Eumicrus tarsatus, Müll. By evening sweeping; Bagley Wood, Wytham Park; scarce.

****Euthia plicata, Gyll.** By evening sweeping, Marston Ferry and Wolvercote; single example.

Cephennium thoracicum, Müll. In moss; Bagley Wood, not common.

FAMILY Clavigeridæ.

***Claviger testaceus, Preyss.** The original British specimen of this singular little beetle, now in the Hope-Westwood collection in the Oxford University Museum, bears the label in Professor Westwood's handwriting, "*Claviger foveolatus*, Müller, 30 Aug., 1838, in ants' nest under stone on New Hill Plain in Whychwood Forest, Oxford, attached to the winged ant on the underside of the body. *J. O. W.*" Professor Westwood subsequently met with the species near Eynsham, and it was also taken by the Rev. A. Matthews at Weston-on-the-Green on May 15th, 1847. (*Zoologist*, p. 1804.) I found it at Wychwood Forest in June, 1904, and at Kirtlington on May 31st, 1906, on the first occasion with its usual host, the little yellow ant, *Lasius flavus*, De G., and on the second with *L. niger*, L.

FAMILY Pselaphidæ.

Pselaphus heisei, Herbst. In damp tufts, flood-rubbish, &c.; Cothill, Marston Ferry, Yarnton, &c.; not rare.

Tychus niger, De G. In tufts and by evening sweeping; fairly common.

***Bythinus puncticollis, Denny.** In damp moss at Yarnton; rare.

B. bulbifer, Reich. In damp moss, tufts, &c., Ogley Bog, Tubney, Yarnton, &c.; common.

***B. curtisi, Denny.** By evening sweeping at Wytham Park; occasional.

Rybaxis sanguinea, L. In damp moss, &c.; Yarnton, not rare.

Bryaxis fossulata, Reich. In moss and by sweeping; Cothill, Tubney, Wytham Park, Yarnton; not rare.

B. hæmatica, Reich. In damp moss, &c.; Ogley Bog, Yarnton; occasional.

B. juncorum, Leach. In tufts, moss, &c.; Marston Ferry, Yarnton, &c.; not rare.

***B. impressa, Panz.** Chiefly in damp moss in spring; Yarnton, common.

***Bibloporus bicolor, Denny.** Among dead sticks, &c.; Wytham Park, rare.

***Euplectus signatus, Reich.** In tufts on old manure-heap, Summertown, scarce.

****E. minutissimus, Aubé.** An example taken by evening sweeping in a damp lane near Summertown, June 4th, 1906. The only previous record of this species as British is by Canon W. W. Fowler and Dr. Garneys, who took it in flood-refuse at Burton-on-Trent in the summer of 1879.

FAMILY **Corylophidæ.**

Corylophus cassidioides, Marsh. In flood-rubbish at Yarnton; common, January, 1906.

FAMILY **Phalacridæ.**

Phalacrus corruscus, Payk. By sweeping in lanes; generally common.

****P. substriatus, Gyll.** Bagley Wood, rare (*W. H.*).

***P. caricis, Sturm.** By sweeping on ditch-banks; Yarnton, May, 1905, sparingly.

Olibrus corticalis, Panz. By sweeping in lanes; Tubney, Wytham Park, &c., not rare.

O. æneus, Fab. On *Matricaria inodora*; Boar's Hill, &c., common.

***O. millefolii, Payk.** By sweeping; Boar's Hill; Ferry Hinksey (*W. H.*).

***O. pygmæus, Sturm.** By sweeping *Filago germanica* in late summer and autumn; Cumnor Hill, Cothill, Tubney; not rare.

Stilbus testaceus, Panz. In tufts, vegetable refuse, and by sweeping; abundant everywhere.

FAMILY **Coccinellidæ.**

Subcoccinella 24-punctata, L. By sweeping; Tubney, not common.

****Hippodamia 13-punctata, L.** "Taken at Oxford in 1819 in June." (*F. W. H.*)

H. variegata, Goeze. On *Matricaria inodora*; Boar's Hill, Cothill, Cumnor, common.

Anisosticta 19-punctata, L. By sweeping in wet places; Marston Ferry, Wolvercote, Yarnton, &c.; not rare. "Taken at Oxford in 1819, in the month of June." (*F. W. H.*)

Adalia obliterata, L. By sweeping under fir-trees; Tubney, not rare.

A. bipunctata, L. Generally common, but not as abundant as in many places.

Mysia oblongoguttata, L.
Anatis ocellata, L. } These two large "lady-birds" occur sparingly on fir-trees at Tubney.

Coccinella 10-punctata, L. By general sweeping; common everywhere.

***C. hieroglyphica, L.** By sweeping heather; Tubney, not rare.

***C. 5-punctata, L.** "Taken on Nettles at Oxford in 1820." (*F. W. H.*).

C. 11-punctata, L. By general sweeping; widely distributed and not rare.

C. 7-punctata, L. By sweeping, on walls, &c.; generally common.

Halyzia 14-guttata, L. By sweeping, chiefly under fir-trees; Tubney, Wytham Park; not rare.

H. 18-guttata, L. By general sweeping; Tubney, Wytham Park, &c.; frequent.

H. conglobata, L. By sweeping; generally common.

H. 22-punctata, L. By sweeping, also in tufts in winter; common. "Taken at Oxford in 1820, in Feb." (*F. W. H.*)

Micraspis 10-punctata, L. Chiefly in damp places; generally common.

***Scymnus nigrinus, Kug.** By sweeping; also in tufts; Bagley Wood, Ogley Bog, Tubney; not rare.

S. frontalis, F. By sweeping; Tubney, Wytham Park, &c., not rare.

S. suturalis, Thunb. By sweeping; Wytham Park, frequent.

S. testaceus, Mots. Tubney (*W. H.*).

S. hæmorrhoidalis, Herbst. By sweeping, also in tufts, moss, &c.; common.

***S. capitatus, F.** Bagley Wood (*W. H.*).

***S. ater, Kug.** Chilswell Hills (*W. H.*).

***Platynaspis luteorubra, Goeze.** By sweeping at Wytham Park; one specimen, 8th May, 1906.

Chilocorus similis, Rossi. By sweeping; Bagley Wood, Tubney, &c.; occasional.

C. bipustulatus, L. With the preceding; occasional.

Exochomus quadripustulatus, L. By sweeping; Bagley Wood, Boar's Hill, Tubney, &c., sometimes very plentiful.

Rhizobius litura, F. By sweeping, in dry tufts, &c.; very common.

Coccidula rufa, Herbst. By sweeping herbage in wet places; generally common.

***C. scutellata, Herbst.** On aquatic herbage; Marston Ferry, rare.

FAMILY **Endomychidæ.**

Mycetæa hirta, Marsh. In rubbish, cellars, &c.; generally common.

***Alexia pilifera, Müll.** "Dorchester, by sweeping." (*J. W. S.*).

***Endomychus coccineus, L.** In fungoid growth under beech bark; Shotover, Wytham Park; not rare.

***Dacne humeralis, F.** In fungus on elm trees; Tubney, fairly common; also at Wytham Park and singly at Christ Church Meadow.

D. rufifrons, F. With the preceding; Tubney and Wytham, common.

FAMILY **Colydiidæ.**

****Oxylæmus variolosus, Dufts.** A single specimen of this exceedingly rare insect taken in a decayed oak faggot in Bagley Wood, 14th May, 1904.

***Orthocerus muticus, L.** In holes in the sand, Tubney, sometimes common (*W. H.*). I have found it there singly on two or three occasions.

Cerylon histeroides, F. Under bark; Bagley Wood, Boar's Hill, Wytham Park; not rare.

***C. ferrugineum, Steph.** Ferry Hinksey (*W. H.*).

FAMILY **Histeridæ.**

Hister unicolor, L. In dead animals; Tubney, frequent. "Taken at Oxford in 1819, equally common with *cadaverinus*, and generally to be taken on the same carrion" (*F. W. H.*).

H. cadaverinus, Hoff. In dead animals; generally common.

H. succicola, Thoms. In carrion, decaying fungi, &c.; Tubney, occasional.

***H. purpurascens, Herbst.** In rabbit-burrows; Boar's Hill, rare, June, 1904.

H. 12-striatus, Schr. In old manure heaps; Summertown, &c.; occasional.

H. bimaculatus, L. Tubney (*W. H.*).

***Carcinops 14-striata, Steph.** One specimen in my house at Summertown, July, 1905.

***Kissister minima, Aubé.** In vegetable refuse ; Godstow, rare.

***Dendrophilus punctatus, Herbst.** In rotten elm ; Wytham Park, rare ; also singly at Tubney.

***Gnathoncus nannetensis, Mars.** In sandpit at Cumnor, among droppings of sand-martins ; not rare, June, 1906.

Saprinus nitidulus, Payk. In dead animals ; not rare.

S. æneus, F. With the preceding : Cothill, Tubney, &c. ; frequent.

****S. virescens, Payk.** By sweeping near Cothill ; one example, May 20th, 1905 (*G. C. Champion*).

***Abræus globosus, Hoff.** In damp rotten wood ; Wytham Park, not rare ; Ferry Hinksey (*W. H.*).

Acritus minutus, Herbst. In old manure heap, Summertown, not rare, spring, 1906.

****Onthophilus globulosus, Ol.** In sand-pit at Tubney, one example, November, 1904 (*W. H.*).

O. striatus, F. In dung ; occasionally by sweeping ; not uncommon.

FAMILY **Micropeplidæ.**

Micropeplus porcatus, Payk.
M. margaritæ, Duv. } Both not uncommon in vegetable refuse and by sweeping, especially in autumn.

FAMILY **Nitidulidæ.**

***Brachypterus gravidus, Ill.** On *Linaria vulgaris ;* Tubney, not rare.

B. pubescens, Er.
B. urticæ, F. } Both these species, especially the latter, abound everywhere on stinging-nettles.

***Cercus pedicularius, L.** On meadow-sweet (*Spiræa ulmaria*) ; common in early summer.

C. bipustulatus, Payk. With the preceding ; very common.

C. rufilabris, Latr. By sweeping in damp grassy places ; common.

Carpophilus hemipterus, L. "Several in a rotting branch in Bagley Wood" (*J. W. S.*).

Epuræa æstiva, L. In hawthorn and other flowers in early summer ; common.

E. melina, Er. With the preceding ; Bagley Wood, occasional.

E. florea, Er. In flowers in early summer ; generally common.

E. deleta, Er. In flowers ; sometimes in fungi ; Wytham Park, not rare.

E. obsoleta, Fab. Chiefly under bark ; Wytham Park ; Boar's Hill (*W. H.*).

***Omosiphora limbata, F.** In fungi on elm trees near Water Eaton ; scarce.

***Micrurula melanocephala, Marsh.** In blackthorn blossom ; Bagley Wood, common, April, 1905.

Nitidula bipustulata, L. In dead animals and birds ; generally common.

***N. rufipes, L.** In dry carrion ; Tubney, not rare, summer, 1906.

Soronia grisea, L. Under willow-bark, Summertown, scarce.

Omosita colon, L. In dry carrion, old bones, &c., common. "Taken at Oxford in 1819" (*F. W. H.*).

O. discoidea, F. With the preceding species ; common. "Taken at Oxford on bones, and is at all times pretty common" (*F. W. H.*).

****Thalycra sericea, Sturm.** Single examples of this rare species have been taken by sweeping at Wytham Park, July 27th, and at Tubney, September 14th, 1905.

Pocadius ferrugineus, F. In puffballs, chiefly in autumn; Tubney, Wytham Park; not rare.

Pria dulcamaræ, Scop. On *Solanum dulcamara;* generally distributed and common.

Meligethes rufipes, Gyll. On hawthorn-blossom, &c., in early summer; common.

M. lumbaris, Sturm. With the preceding; Bagley Wood, Wytham Park, &c., not rare.

M. æneus, F. In flowers, spring and early summer; abundant.

M. viridescens, F. Occurs with the preceding, but much more rarely.

M. difficilis, Heer. On *Lamium album;* fairly common.

***M. brunnicornis, Sturm.** On flowers in marshy places, not rare; Boar's Hill, Tubney; King's Weir (*W. H.*).

***M. ovatus, Sturm.** Chiefly on thistles; Tubney, Wytham Park, &c.; not rare.

M. picipes, Sturm. In flowers throughout the summer; common.

***M. murinus, Er.** On flowers of *Echium vulgare;* Tubney, Wytham Park; common.

M. erythropus, Gyll. By sweeping; Cothill, Tubney, &c.; frequent.

Cychramus luteus, F. In hawthorn blossom, &c., early summer; common.

C. fungicola, Heer. In fungi in autumn; Boar's Hill, Tubney, Wytham Park; not rare.

***Cryptarcha strigata, F.** By sweeping at Wytham Park, rare, September, 1905. This species is usually found in the burrows of the larva of *Cossus ligniperda.*

***Ips quadripunctata, Herbst.** Under oak bark, Bagley Wood (*A. H. H.*); taken rather freely in a sappy oak stump outside Wytham Great Wood by Mr. J. Collins and myself, April, 1906.

Rhizophagus perforatus, Er. By sweeping and under bark; Wytham Park, frequent.

R. bipustulatus, F. Under bark; generally distributed and common.

FAMILY **Trogositidæ.**

Tenebrioides mauritanicus, L. In bakers' shops, Oxford (*A. H. H.*).

FAMILY **Monotomidæ.**

Monotoma spinicollis, Aubé. By sweeping near Cothill; rare.

M. picipes, Herbst. In vegetable refuse, manure-heaps, &c.; Summertown, not rare.

FAMILY **Lathridiidæ.**

Lathridius lardarius, De G. By sweeping; widely distributed and not rare.

L. angulatus, Mann. In old faggots; Bagley Wood, occasional.

***L. bergrothi, Reitt.** Taken freely by Mr. W. Holland among faggots, rubbish, &c., in his cellar in Observatory Street, Oxford.

Coninomus nodifer, Westw. In dead sticks and vegetable refuse, and by sweeping; generally common.

Enicmus minutus, L. Among dead leaves, by sweeping, &c.; common.

E. transversus, Ol. With the preceding species; common.

****E. testaceus, Steph.** On fungi and by sweeping; Wytham Park, rare.

Cartodere ruficollis, Marsh. In vegetable refuse; Summertown, Wytham Park, &c., frequent.

Corticaria pubescens, Gyll.
C. crenulata, Gyll.
C. elongata, Gyll.
These three species are generally but rather sparingly distributed, among vegetable refuse, also by sweeping.

Melanophthalma gibbosa, Herbst. By sweeping; fairly common.

M. fuscula, Humm. By sweeping, among dead sticks, &c.; very common.

FAMILY **Cucujidæ.**

****Pediacus dermestoides, F.** This fine insect has been taken sparingly at Wytham Park under bark of oak and ash, April and November, 1906.

Læmophlæus ferrugineus, Steph. Under bark; Wytham Park, not rare.

Psammœchus bipunctatus, F. In wet places, among reeds, &c.; King's Weir, Tubney, Water Eaton, Wytham Park, &c.; sometimes plentiful.

Silvanus unidentatus, Ol. Under oak bark; Boar's Hill, Wytham Park, &c.; not rare.

FAMILY **Byturidæ.**

Byturus sambuci, Scop. In flowers; common in early summer.

B. tomentosus, F. With the preceding; common. "Taken at Oxford in 1820" (*F. W. H.*).

FAMILY **Cryptophagidæ.**

***Diphyllus lunatus, F.** In black fungus (*Hypoxylon concentricum*) on old ash trees; Wytham Park, common, April, 1905; also rarely near Summertown.

Telmatophilus caricis, Ol. On water plants on banks of rivers and streams; common.

***T. typhæ, Fall.**
***T. schönherri, Gyll.**
Taken freely in dead bulrushes (*Typha latifolia*) at Cothill, September 27th, 1906.

***Antherophagus nigricornis, F.** By sweeping; Bagley Wood, Tubney, Water Eaton, Wytham Park, &c.; scarce.

***A. pallens, Ol.** By sweeping, near Tubney, one example, July 17th, 1906.

Cryptophagus lycoperdi, Herbst. In puffballs; Tubney, scarce.

C. setulosus, Sturm. By sweeping; Wytham Park, occasional.

C. pilosus, Gyll. In vegetable refuse and by sweeping; not rare.

****C. populi, Payk.** Under bark and in fungus on dead elm; Tubney, rare.

C. umbratus, Er. Tubney (*W. H.*).

C. scanicus, L. In fungus on trees; generally common.

C. dentatus, Herbst. In vegetable refuse, under bark, and by sweeping; very common.

C. cellaris, Scop. In vegetable refuse; often in houses; Oxford, occasional.

***C. pubescens, Sturm.** By evening sweeping at Wytham Park; occasional.

Micrambe vini, Panz. On flowers of broom, furze, &c., and by sweeping; common.

****Atomaria fimetarii, Herbst.** By evening sweeping at Wytham Park; one specimen, September 2nd, 1905.

A. nigriventris, Steph. In tufts of grass; King's Weir, scarce.

***A. umbrina, Gyll.** In old faggots; Bagley Wood, rare.

A. linearis, Steph. By sweeping; Wytham Park, &c., frequent.

A. fuscipes, Gyll. In moss; Yarnton, scarce.

A. atricapilla, Steph. In vegetable refuse and by sweeping; fairly common.

A. basalis, Er. Among dead leaves near Islip; rare.

A. mesomelas, Herbst. In damp moss and tufts, &c.; Binsey, King's Weir, Yarnton, &c., fairly common. An entirely black variety, occurs rarely.

A. ruficornis, Marsh. In vegetable refuse and by sweeping; common.

Ephistemus gyrinoides, Marsh. Chiefly in vegetable refuse; generally common.

FAMILY Scaphidiidæ.

Scaphisoma agaricinum, L. Under damp bark and on fungi; Wytham Park, not rare.

FAMILY Mycetophagidæ.

Typhæa fumata, L. In dead sticks, vegetable refuse, &c.; generally common.

***Triphyllus suturalis, F.** In dry fungi on old trees; Tubney, Water Eaton, Wytham Park, &c.; sometimes plentiful.

T. punctatus, F. Tubney (*W. H.*).

Litargus bifasciatus, F. Under loose dry bark of ash, &c.; Wytham Park, not rare.

Mycetophagus quadripustulatus, L. In tree fungi; generally distributed and often abundant.

***M. piceus, F.** "Taken in 1820 in the Botanic Garden at Oxford" (*F. W. H.*).

M. multipunctatus, Hell. In fungi on willow, also under dry oak bark; near Water Eaton, and Wytham Park, not rare.

FAMILY Dermestidæ.

Dermestes vulpinus, F. "Taken at Oxford in 1821" (*F. W. H.*).

D. murinus, L. On small dead animals and birds; common. "Taken on the bodies of dead moles in immense numbers at Lord Abingdon's at Witham in 1817" (*F. W. H.*).

D. lardarius, L. In houses, shops, &c., Oxford, occasional. "Taken at Oxford in 1820, the larvæ are taken on salted hams and bacon" (*F. W. H.*).

Attagenus pellio, L. On walls in the city, occasional; very common in the University Museum in the spring and early summer.

***Tiresias serra, F.** Marston Ferry, under bark, one example, June 25th, 1905. The curious hairy larva is not rare under dry elm bark at Tubney, and may be easily reared to the perfect state by feeding it on dead flies.

Florilinus musæorum, L. In houses; frequent. Common in spring in the University Museum.

Helocerus claviger, Er. On umbelliferous flowers; Tubney, Wytham Park, &c., not rare.

Family **Byrrhidæ.**

***Syncalypta hirsuta, Sharp.** Under stones in sandy places, Frilford Heath near Tubney; very local but not rare.

Byrrhus pilula, L. In sandpits and on paths in spring; not rare. "Common in 1820 under the yew trees in St. John's garden at Oxford" (*F. W. H.*).

B. fasciatus, F. In sandpits; Cumnor, Tubney; not rare. "Taken at Oxford in 1820" (*F. W. H.*).

***B. dorsalis, F.** In sandpits; Tubney, frequent, chiefly in spring.

***B. murinus, F.** In sandpit, Tubney (*W. H.*).

Cytilus varius, F. In rather damp places, by sweeping; Cothill, Ogley Bog, Tubney, Wytham Park, &c., not rare. "Taken on water plants on the banks of the Isis at Oxford" (*F. W. H.*).

Simplocaria semistriata, F. By sweeping, chiefly in autumn; Cothill, Elsfield, Tubney, Wytham Park, &c.; not rare.

***Aspidophorus orbiculatus, Gyll.** By sweeping near Water Eaton; one example, August 6th, 1906.

Family **Parnidæ.**

Elmis æneus, Müll. In running streams, adhering to stones; generally common.

Limnius tuberculatus, Müll. By sweeping, Cherwell banks near Water Eaton, rare.

Parnus prolifericornis, F. In damp places; generally common.

P. auriculatus, Panz. With the preceding species; Cothill, scarce.

Family **Heteroceridæ.**

Heterocerus marginatus, F. On banks of ponds, burrowing in mud; Marston, Tubney; not rare.

Family **Lucanidæ.**

Lucanus cervus, L. The Stag Beetle. Of occasional occurrence at Shotover and other localities near Oxford (*A. H. H.*).

Dorcus parallelopipedus, L. In rotten wood, chiefly of ash; Summertown, Wytham Park; not rare.

Sinodendron cylindricum, L. In rotten willow near Water Eaton (*J. C.*).

****Platycerus caraboides, L.** "This species long doubted as a native of this country, was taken in July at Oxford not far from Witham, cut out of a dry and almost sapless oak. Another was taken flying not far from the city in 1820. I have heard it was taken near Eton by a Mr. Durell, and also flying in the High St. at Oxford. It has also been taken at Lord Abingdon's Park near Oxford" (*F. W. H.*). The species, although it exists in several old British collections, has not been taken in these islands for many years, and its name has disappeared from all our recent catalogues.

Family **Scarabæidæ.**

Onthophagus ovatus, L. In dung, chiefly in sandy places; generally common.

O. vacca, L. Bagley Wood (*J. W. S.*).

O. fracticornis, Preyss. In dung, Bagley Wood (*W. H.*).

Aphodius erraticus, L. In dung, Boar's Hill (*W. H.*). "Taken at Oxford in 1819; it is more abundant in August than any part of the Year" (*F. W. H.*).

A. subterraneus, L. In dung; near Water Eaton, frequent (*J. C.*).

A. fossor, L. In dung; occasionally at light; very common.

A. hæmorrhoidalis, L. In dung, flood-rubbish, &c.; Yarnton, scarce.

***A. fœtens, F.** In dung, in late summer; Cothill, Elsfield, Tubney; rather scarce. "Taken at Oxford in 1819." (*F. W. H.*).

A. fimetarius, L. In dung; very common, especially in spring.

A. scybalarius, F.
A. ater, De G. } These two species occur commonly throughout the district in dung.

A granarius, L. In dung; widely distributed, but not very common.

A. nitidulus, F. In dung; Boar's Hill, rare.

A. sordidus, F. Taken in dung at Radley, July, 1906. "Oxon, 1819; taken in May, 1820." (*F. W. H.*).

A. rufescens, F. In dung; widely distributed, but rather scarce.

A. borealis, Gyll. In dung; Bagley Wood, rare.

***A. porcus, F.** By sweeping at Cothill; one example, September 27th, 1906.

A. pusillus, Herbst. In dung; generally distributed and not rare.

A. merdarius, F. In dung; fairly common. "Taken about puddles near Oxford in 1822: in pig dung in the autumn." (*F. W. H.*).

A. inquinatus, F. In dung; often by sweeping in autumn; Cothill, Tubney, common.

***A. sticticus, Panz.** In dung; Boar's Hill, rather scarce.

A. punctato-sulcatus, Sturm. In dung; chiefly in autumn; common. "Taken at Oxford in 1819" (*F. W. H.*).

A. prodromus, Brahm. With the preceding; fairly common.

A. contaminatus, Herbst. In dung, especially in autumn; common. "Taken at Oxford in 1819" (*F. W. H.*).

***A. obliteratus, Panz.** In dung and frequently by sweeping; Tubney, Wytham Park; fairly common.

A. luridus, F. In dung; Elsfield, Wytham Park; not very common. "In 1819 taken at Oxford, it varies much. *S. gagates*, Geoff. taken at Oxford in 1820. *Gagates* is a var. of (*Aphodius*) *luridus*, α" (*F. W. H.*).

A. rufipes, L. In dung, and frequently flies to light; very common.

****Heptaulacus villosus, Gyll.** Single examples of this rare species taken by Mr. Holland and myself by sweeping on Frilford Heath, July 11th, 1904. It has also been taken at Wychwood Forest, and at Streatley, Berks.

***Oxyomus porcatus, F.** In tufts of grass in old manure heap, Summertown, common, spring, 1906; also rarely at Ogley Bog.

Geotrupes typhœus, L. Under dung in sandy places; Tubney, not rare.

G. spiniger, Marsh.
G. stercorarius L. } Both species common throughout the district, burrowing under dung, and flying in the evening.

G. sylvaticus, Panz. In dung, putrid fungi, &c.; not rare, and widely distributed. "Taken at Oxford in 1819, this insect may be taken in the ditches at Shotover Hill in May and in very great abundance" (*F. W. H.*).

***Trox sabulosus, L.** Under rabbit-skins and other dry carrion put down as traps; Tubney, not rare in early summer. "Taken after a flood at Oxford in 1820 in January" (*F. W. H.*).

T. scaber, L. Once in my house at Summertown; Tubney (*W. H.*). "Taken at Oxford during a flood in 1819—taken in 1822 on reeds by the waterside near Bossom's house" (*F. W. H.*).

Hoplia philanthus, Füss. On the wing at Cothill and Tubney; rather scarce.
Serica brunnea, L. Tubney, chiefly in sandpits; common in summer.
Rhizotrogus solstitialis, L. On the wing about trees at midsummer; sometimes very plentiful. "Taken at Oxford in 1820-1" (*F. W. H.*).
Melolontha vulgaris, L. The common Cockchafer. By beating trees, and flying at sunset; often common in May and June.
Phyllopertha horticola, L. Chiefly on bracken; Tubney, &c., sometimes plentiful in summer. "Taken at Oxford in 1819." (*F. W. H.*).
Cetonia aurata, L. The Rose-beetle. In flowers in early summer; Bagley Wood, &c., not rare; also frequent on roses, &c., in gardens.

Family **Buprestidæ.**

***Agrilus laticornis, Ill.** By sweeping in Bagley Wood (*J. W. S.*).
***A. angustulus, Ill.** By sweeping, and on young oaks; Tubney, occasional.
****Aphanisticus pusillus, Ol.** In moss at Bagley Wood (*J. W. S.*).
***Trachys minuta, L.** On sallows at Bagley Wood, early summer, not rare.
****T. pumila, Ill.** By sweeping *Glechoma hederacea*, &c., in open places at Tubney and Wytham Park; also occasionally in sandpits; early summer, sparingly.
****T. troglodytes, Gyll.** One example of this rare insect taken by my nephew, H. G. Champion, by sweeping at Cothill, April 21st, 1906.

Family **Eucnemidæ.**

Throscus dermestoides, L. By evening sweeping; Bagley Wood, scarce.
***T. carinifrons, Bonv.** By evening sweeping; Bagley Wood, Wytham Park; occasional.
****Melasis buprestoides, L.** In dead hornbeam, Bagley Wood, a few specimens, February, 1905.

Family **Elateridæ.**

Lacon murinus, L. In sandy places, sometimes flying; Tubney, common. "Capt. Oxford, 1819" (*F. W. H.*).
***Cardiophorus asellus, Er.** In sandpits, Tubney (*W. H.*).
Cryptohypnus riparius, F. In tufts, vegetable refuse, &c.; Tubney, not rare.
***C. 4-pustulatus, F.** By sweeping in meadows; near the Cherwell, very common in early summer; also at Tubney, Ferry Hinksey, &c.
****Elater rufipennis, Steph.** "This species . . . was taken in 1821 under the bark of oak trees in July at Bagley Wood, Oxon" (*F. W. H.*). It is now extremely rare in Britain.
****E. elongatulus, F.** Tubney; a few examples taken in decayed fir trunks in May, 1906, by Mr. J. Collins and myself.
E. balteatus, L. Bagley Wood, not rare on hazel (*J. W. S.*).
****Ischnodes sanguinicollis, Panz.** "Some dead specimens in a rotting log at Dorchester" (*J. W. S.*).
Melanotus rufipes, Hbst. In rotten Wood; Bagley Wood, Tubney, &c., occasional.
Athöus niger, L. By sweeping in lanes; generally common in summer.
A. longicollis, Ol. By sweeping in grassy places; fairly common, especially the male.

A. hæmorrhoidalis, F. On shrubs in woods and lanes; common, early summer.

A. vittatus, F. By sweeping in woods; Bagley Wood, Tubney; not rare.

*__Limonius cylindricus, Payk.__ In sandy places at Tubney; locally common in spring.

L. minutus, L. By sweeping in woods, lanes, &c.; early summer, common.

Adrastus limbatus, F. By sweeping in early summer; Bagley Wood, Tubney, &c.; not rare. "Taken at Oxford in 1819; Bagley Wood and Lord Abingdon's" (*F. W. H.*).

Agriotes sputator, L., **A. obscurus, L.**, **A. lineatus, L.** These three species are generally plentiful under stones, vegetable refuse, &c., and their larvæ are too well known as "wire worms."

A. sobrinus, Kies., **A. pallidulus, Ill.** Both fairly common by beating and sweeping at Bagley Wood, Boar's Hill, Wytham Park, &c.

Dolopius marginatus, L. In woods, with the two preceding species, not rare. "Taken at Oxford in 1819, also in 1822" (*F. W. H.*).

*__Corymbites pectinicornis, L.__ Bagley Wood (*J. W. S.*).

*__C. tessellatus, F.__ By sweeping in damp places in early summer; Cothill, not rare; Tubney (*W. H.*).

C. quercus, Gyll. By sweeping on banks of Cherwell, frequent; Bagley Wood (*J. W. S.*).

C. holosericeus, F. By sweeping, early summer; Tubney, Wytham Park, not rare. "In 1820 I took it at Oxford" (*F. W. H.*).

*__C. metallicus, Payk.__ Single specimens have been taken at Marston Ferry, June 4th, 1906, by myself, in Magdalen College Grounds (*J. W. S.*), and in the University Museum (*W. H.*).

*__C. bipustulatus, L.__ Tubney (*W. H.*). "Taken at Bagley Wood, Oxfordshire, 1820" (*F. W. H.*).

Campylus linearis, L. By sweeping in woods; not uncommon.

FAMILY Dascillidæ.

Helodes minuta, L. By sweeping in damp places; common, early summer.

*__H. marginata, F.__ With the preceding species (*W. H.*).

Microcara livida, F. On flowers in early summer; not rare.

Cyphon coarctatus, Payk. By sweeping in damp places; fairly common.

C. variabilis, Thunb. In damp places; often very abundant in summer.

C. pallidulus, Boh. With the preceding species; Marston Ferry, Ogley Bog; frequent.

*__Scirtes hemisphæricus, L.__ By sweeping rushes in wet places; Ogley Bog, not rare.

**__Eubria palustris, Germ.__ This rare and curious little beetle is found sparingly at Ogley Bog, by sweeping in very wet places on hot evenings early in July.

FAMILY Lampyridæ.

Lampyris noctiluca, L. The Glow-worm. On hedge-banks, &c.; common.

FAMILY Telephoridæ.

*__Podabrus alpinus, Payk.__ In Bagley and other woods, on flowers, general (*W. H.*).

***Telephorus fuscus, L.** "I once took 8 or 9 of them at Bagley Wood near Oxford" (*F. W. H.*).

T. rusticus, Fall.
T. lividus, L. } On hedges, paths, and in flowers; common everywhere in early summer.

T. pellucidus, F.
T. nigricans, Müll.
T. lituratus, Fall. } These three species are found more or less commonly on flowers, foliage, &c., in woods throughout the district in early summer.

T. bicolor, F.
T. hæmorrhoidalis, F. } Chiefly on hawthorn-blossom; Bagley Wood, Tubney, Wytham Park, &c.; both not rare.

***T. oralis, Germ.** Chilswell Hills (*W. H.*).

T. flavilabris, Fall. By sweeping in grassy places; not rare in early summer.

***T. thoracicus, Ol.** By sweeping aquatic herbage; banks of Cherwell at Marston, &c., not rare.

Rhagonycha fuscicornis, Ol. Chiefly on hawthorn-blossom in woods; fairly common.

R. fulva, Scop. On flowers, late summer, abundant. "Taken at Oxford in 1820" (*F. W. H.*).

***R. testacea, L.** "Taken at Oxford in 1820" (*F. W. H.*).

R. limbata, Thoms. On hawthorn-blossom; generally common.

R. pallida, F. With the preceding, not uncommon. "Taken at Oxford in 1820" (*F. W. H.*).

Malthinus punctatus, Fourc.
M. fasciatus, Ol.
M. balteatus, Suffr. } All found more or less commonly in early summer on flowers and foliage at Bagley Wood, Tubney, and other wooded places.

Malthodes marginatus, Latr. On flowers, bushes, &c.; Bagley Wood, Tubney, &c., not rare. "Taken at Oxford in 1820" (*F. W. H.*).

M. minimus, L. By sweeping in woods; generally common.

M. atomus, Thoms. By sweeping at Wytham Park; scarce.

Malachius æneus, L. On flowers, and flying: Bagley Wood, Godstow, &c.; scarce.

M. bipustulatus, L. On flowers and by sweeping; generally common.

M. viridis, F. By sweeping in grassy places, lanes, &c.; Cothill, Tubney, Wytham Park; common in summer.

***Anthocomus fasciatus, L.** By sweeping in damp grassy places; Marston Ferry, Tubney; Ferry Hinksey (*W. H.*); not rare.

Dasytes flavipes, F.
D. ærosus, Kies. } Both species are fairly common in woods on flowers, shrubs, &c., in early summer.

****Haplocnemus impressus, Marsh.** By sweeping at Wytham Park; one example, May 8th, 1906.

****H. nigricornis, F.** On hawthorn-blossom, Bagley Wood; one example, May 16th, 1904.

***Phlœophilus edwardsi, Steph.** By sweeping under trees in autumn; Wytham Park, rare.

Family **Cleridæ**.

***Thanasimus formicarius, L.** Under willow-bark, Summertown, rare (*J. C.*).

Necrobia ruficollis, F. In rather dry carrion, not rare. "Taken on carrion at Oxford in 1819" (*F. W. H.*).

N. violacea, L. With the preceding, often common. "Taken at Oxford in 1819. Taken in 1822" (*F. W. H.*).

N. rufipes, De G. Occurs not rarely with the two preceding species.

FAMILY **Ptinidæ.**

***Ptinus lichenum, Marsh.** "Taken at Oxford in 1819" (*F. W. H.*).
P. fur, L. In houses, common; abundant in the University Museum.
Niptus hololeucus, Fall. In cupboards in houses; frequent.
***Hedobia imperialis, L.** Near Bagley Wood, in dead hedges, sparingly.

FAMILY **Anobiidæ.**

***Dryophilus pusillus, Gyll.** By sweeping, chiefly under fir-trees; Tubney, Wytham Park, &c.; scarce.
Priobium castaneum, F. By beating hedges; often on the wing; generally common.
Anobium domesticum, Fourc.
,, fulvicorne, Sturm.
} Among dead sticks and by sweeping; often in houses; common. The first species is the notorious "Death-watch."
Xestobium tessellatum, F. Oxford, on walls; "attacking large numbers of willow trees at Oxford" (*J. W. S.*).
Ernobius mollis, L. In fir palings and by sweeping; Boar's Hill, Wytham Park, &c.; not rare.
Ptilinus pectinicornis, L. In dead beech at Wytham Park, abundant. "Taken at Oxford on willow trees where the bark had perished, 1819" (*F. W. H.*).
***Ochina hederæ, Müll.** By sweeping; Water Eaton, Wytham Park, &c.; not rare. "On dead ivy in Magdalen College grounds" (*J. W. S.*).
***Cœnocara bovistæ, Hoff.** Single examples have been taken by sweeping at Tubney, July 17th, and at Boar's Hill, September 8th, 1906. Its usual habitat is in puff-balls.

FAMILY **Lyctidæ.**

Lyctus canaliculatus, F. Summertown, on the wing; Bagley Wood (*W. H.*).

FAMILY **Cissidæ.**

Cis boleti, Scop. In fungi on old stumps, &c.; very common.
C. villosulus, Marsh. "Taken at Oxford in 1821" (*F. W. H.*).
***C. bidentatus, Ol.** In fungi on old trees; Tubney, Wytham Park; common.
***C. alni, Gyll.** Under bark, in faggots, &c.; Bagley Wood, Cothill; Tubney (*W. H.*).
Octotemnus glabriculus, Gyll. In fungi on old stumps, &c.; not rare.

FAMILY **Cerambycidæ.**

Aromia moschata, L. The Musk-beetle. About old willows near the river banks, occasional (*A. H. H., W. H.*). "Taken at Oxford in 1819. It is in some years extremely common and in others scarcely ever to be taken. It is fond of willows" (*F. W. H.*).
***Tetropium crawshayi, Sharp.** One specimen of this Longicorn, quite recently added to our list, taken on the roadside between Marston and Elsfield, June 25th, 1905.
***Callidium violaceum, L.** About fir palings, &c.; sometimes very common at Boar's Hill; occasionally at Bagley Wood, Summertown, &c.
***C. variabile, L.** "Taken at Bagley Wood in 1819" (*F. W. H.*).

***C. alni, L.** On flowers, dead twigs, &c., Bagley Wood (*W. H.*). "Taken at Oxford in 1819" (*F. W. H.*).

Clytus arietis, L. On hawthorn-blossom, fences, &c.; early summer, common.

***C. mysticus, L.** On hawthorn-blossom; Bagley Wood, near Marston, &c.; sparingly. "Taken in the Botanic Garden at Oxford" (*F. W. H.*).

Rhagium inquisitor, F. } These two species are generally distributed
R. bifasciatum, F. } in woods, on flowers and about old timber.

Toxotus meridianus, L. On hawthorn-blossom, Bagley Wood, Wytham Park; not rare. "Taken in Bagley Wood near Oxford by beating the hedges in 1819. Fond of the Dog Rose, there are several varieties" (*F. W. H.*).

Leptura livida, F. On flowers and by sweeping; Tubney, common in July. "Taken at Oxford in 1819." (*F. W. H.*).

Strangalia armata, Herbst. On flowers; Cothill, Tubney, &c.; not rare.

S. melanura, L. On hawthorn-blossom; Bagley Wood, Tubney, &c., frequent. "Taken at Oxford in 1819 on the White Thorn" (*F. W. H.*).

Grammoptera tabacicolor, De G. On hawthorn-blossom; Bagley Wood, Tubney, &c., not rare. "Taken at Oxford in 1820 while beating the May in blossom" (*F. W.H.*).

G. ruficornis, F. On hawthorn-blossom, &c.; generally common.

FAMILY **Lamiidæ.**

***Acanthocinus ædilis, L.** Single specimens of this fine Longicorn beetle, which has its head-quarters in the pine-forests of the Scottish Highlands, have been taken at Bagley Wood, August 14th, 1892, by Mr. J. W. Shipp ('Ent. Mo. Mag., vol. xxviii, p. 288), and by Mr. W. Holland in the city.

Leiopus nebulosus, L. By sweeping in woods and lanes; Bagley Wood, Boar's Hill, Wytham Park, Summertown, &c.; fairly common.

***Pogonochærus bidentatus, Th.** Among dead sticks; Bagley Wood, scarce.

P. dentatus, Fourc. In old hedges; Oxford (*A. H. H.*).

***Saperda populnea, L.** Among aspens; Bagley Wood (*W. H.*).

Tetrops præusta. On hawthorn-blossom, &c.; Bagley Wood, Tubney, Water Eaton, &c.; not rare.

****Phytœcia cylindrica, L.** By sweeping in lane near Tubney; one specimen, May 20th, 1905.

****Oberea oculata, L.** "Taken in 1819 in Oxford. I have captured three specimens of this rare insect on the leaves of the Arbutus. It makes a curious noise with its thorax" (*F. W. H.*). Now practically confined to the Cambridgeshire Fens.

FAMILY **Bruchidæ.**

Bruchus cisti, F. Taken rarely on *Helianthemum vulgare* at Kirtlington, May 31st, 1906.

B. rufimanus, Boh. By sweeping, Marston Ferry, rare; Tubney (*W. H.*).

***B. seminarius, L.** "Taken by Baxter of the Botanic Garden at Oxford, where it is not uncommon" (*F. W. H.*).

FAMILY **Chrysomelidæ.**

***Orsodacna lineola, Panz.** On hawthorn in spring, Marston Copse, sparingly (*W. H.*).

***Donacia crassipes, F.** On leaves of water-lilies; common on the Cherwell near Water Eaton, but difficult to secure. "Taken at Oxford in 1820" (*F. W. H.*).

***D. dentata, Hoppe.** On *Sagittaria*, &c., banks of Cherwell; common in summer.

***D. versicolora, Brahm.** On water plants, banks of Cherwell, &c. (*W. H.*).

***D. sparganii, Ahr.** On the banks of the Cherwell; not uncommon in summer (*W. H.*).

D. limbata, Panz. On *Sparganium*; banks of Cherwell, &c., common. "Taken at Oxon in 1819" (*F. W. H.*).

***D. thalassina, Germ.** On aquatic plants, Cherwell banks, &c., scarce.

****D. impressa, Payk.** On *Glyceria aquatica*, Cherwell banks near Water Eaton, rare; King's Weir (*W. H.*).

D. simplex, F. On aquatic plants; generally distributed and common.

***D. semicuprea, Panz.** Chiefly on *Glyceria aquatica*; Cherwell banks, &c., often very plentiful in summer. "Taken in 1820 at Oxford about a mile from the city on the Abingdon road on the left hand where the brooks cross" (*F. W. H.*).

D. sericea, L. On aquatic plants; widely distributed and common; exceedingly variable in colour. "Taken commonly at Oxford in 1819" (*F. W. H.*).

***D. affinis, Kunze.** On rushes in early summer; Cothill, Marston Ferry, Yarnton, &c., sometimes abundant. "Taken in Xt. Church Meadow in 1819 on the flags by the waterside" (*F. W. H.*).

****Hæmonia appendiculata, Panz.** There are two examples of this curious and exceedingly rare beetle in the Hope-Westwood collection of British Coleoptera in the University Museum, taken by Dr. W. Hatchett Jackson on water-weeds in the Thames near Binsey, July, 1892.

***Zeugophora subspinosa, F.** On aspen; Tubney, not rare in summer.

Lema cyanella, L. By sweeping and in tufts of grass in winter; generally common. "Taken at Oxford in 1819" (*F. W. H.*).

***L. lichenis, Vœt.** On thistles; Boar's Hill, not common.

L. melanopa, L. By sweeping; generally common throughout the summer. "Taken at Oxford in 1819, the same as above [*cyanella*]. This year 1821 I have taken more than 50, they are very plentiful at present Septr. 12, tho' at other times of the year they may be considered rare" (*F. W. H.*).

Crioceris asparagi, L. The Asparagus beetle. In gardens, on foliage of Asparagus, also by sweeping at Summertown, &c.; not rare.

****C. 12-punctata, L.** "Taken at the Botanic Garden, Oxford" (*F. W. H.*). In the Hope-Westwood collection there are several examples of this pretty beetle, in all probability the Oxford specimens alluded to above, but the insect now figures in our lists as a doubtfully British species.

***Clythra quadripunctata, L.** Tubney (*W. H.*).

[****Gynandrophthalma affinis, Hell.** Although not found in our district as limited for the purposes of the present list, this interesting beetle must be mentioned as occurring not rarely on hazel, &c., at Wychwood Forest, where it was discovered by Mr. W. Holland on June 18th, 1899.]

***Cryptocephalus bipunctatus, L. var. lineola, F.** Boar's Hill (*W. H.*).

*C. **aureolus, Suff.** "Taken at Oxford in 1819 on the dandelion" (*F. W. H.*).

*C. **hypochæridis, L.** Cothill, by sweeping, rare. "Taken in 1819 in Oxford on willows" (*F. W. H.*).

*C. **moræi, L.** Ogley Bog, by sweeping, rare.

C. **fulvus, Goeze.** By sweeping in dry places; Tubney, abundant.

C. **labiatus, L.** By sweeping; generally common in woody places.

C. **frontalis, Marsh. On sallow near Marston Ferry; rare, August, 1903 (*W. H.*).

***Lamprosoma concolor, Sturm.** By sweeping at Wytham Park; rare.*

Timarcha tenebricosa, F. On bedstraw in hedges, &c.; often on pathways; common, especially in spring. "Taken in company with *Meloë proscarabæus* in 1819, in going up Shotover Hill" (*F. W. H.*).

T. **violaceonigra, De G.** In dry places; Shotover, Tubney, &c., often common (*A. H. H., W. H.*). "Capt. Oxon, 1819" (*F. W. H.*).

***Chrysomela marginalis, Dufts.** On *Linaria vulgaris*, sometimes plentiful; also on walls, pathways, &c.; Bagley Wood, Summertown; Boar's Hill (*W. H.*).

*C. **banksi, F.** A single specimen of this conspicuous species was given to me in 1905 by the Rev. W. Mansell Merry, which he believed he had taken at Bagley Wood. Inserted provisionally.

C. **staphylæa, L.** In damp places, by sweeping, also in tufts in winter; generally common. "Taken in astonishing myriads if I may use the expression at Oxford in 1819 during a flood" (*F. W. H.*).

C. **polita, L.** In damp places, on *Mentha*, &c.; generally common. "Capt. at Oxford in 1819, it varies very much in size and colour" (*F. W. H.*).

*C. **varians, Schall.** On *Hypericum;* Bagley Wood, not common.

*C. **gœttingensis, L.** This usually scarce species appears to be much more plentiful in this district than in most others; I have taken it sparingly at Elsfield, Wytham Park, and Tubney, and Mr. Holland has found it abundantly in the last mentioned locality, at roots of herbage.

*C. **fastuosa, Scop.** "One at Oxford in 1819" (*F. W. H.*).

*C. **didymata, Scriba.** On *Hypericum quadrangulum* and *H. perforatum* in autumn; Bagley Wood and Tubney, plentiful; also rarely at Elsfield and Ogley Bog. "Taken at Oxford in 1819" (*F. W. H.*).

C. **hyperici, Forst.** On *Hypericum;* Bagley Wood, Tubney; common.

***Melasoma tremulæ, F.** On aspen, Bagley Wood (*W. H.*).

***Phytodecta rufipes, De G.** Bagley Wood (*W. H.*).

*P. **viminalis, L.** On sallows in early summer; Bagley Wood, Tubney; not rare.

P. **olivacea, Forst.** By sweeping at Cothill, scarce.

Gastroidea polygoni, L. In waste places, on weeds (*Polygonum, &c.*); very common.

***Plagiodera versicolora, Laich.** This species, usually esteemed local and scarce, occurs in profusion in June on small willow bushes by the side of the path leading from the Reservoirs to South Hinksey. King's Weir (*W. H.*).

Phædon tumidulus, Germ. On *Heracleum* and other Umbelliferous plants; generally common.

P. **armoraciæ, L.** (=**P. betulæ, Kust.**). In damp places generally common. "Taken commonly on Willows at Oxford. Betulæ in some years is seen in countless numbers. After a flood near Oxford millions were seen amongst the rubbish left by the retiring water of the river" (*F. W. H*).

P. **cochleariæ, F.** With the preceding species; generally common.

Phratora vulgatissima, L. On willow, aspen, poplar, &c.; not rare.

P. vitellinæ, L. Chiefly on willows; widely distributed and often common. "Taken at Oxford in 1819 on willows in very great abundance" (*F. W. H.*).

Hydrothassa aucta, F. In damp places; Bagley Wood (*W. H.*). "Taken at Oxford in 1819" (*F. W. H.*).

H. marginella, L. In damp places; also in tufts in winter; very common. "Taken at Oxford in 1819, it often is taken on the *Phellandrium aquaticum*" (*F. W. H.*).

Prasocuris junci, Brahm. On aquatic herbage on river-banks, not rare.

P. phellandrii, L. With the preceding species; King's Weir, Water Eaton, Yarnton, &c.; frequent.

Luperus rufipes, Scop. On hazel, birch and other shrubs; common in woods.

L. flavipes, L. With the preceding species, but less common; Bagley Wood, Tubney, &c.

Lochmæa capreæ, L. On willows and sallows; Cothill, Tubney, &c.; not rare.

L. suturalis, Th. On heather; Tubney, plentiful; the black var. **nigrita, Weise,** frequent in autumn.

L. cratægi, Forst. Chiefly on hawthorn-blossom; Bagley Wood, Cothill, Tubney, Wytham Park; fairly common. "Common at Oxford at Bagley Wood on the white thorn. I have also taken it on aquatic plants" (*F. W. H.*).

***Galerucella viburni, Payk.** On *Viburnum Lantana* in late summer; Tubney, locally common.

***G. lineola, F.** On aquatic plants; Cherwell banks, Marston Ferry, sparingly.

G. tenella, L. By sweeping in damp places; Marston Ferry, Yarnton, &c., common.

Adimonia tanaceti, L. On tansy, thistles, &c.; Shotover, sometimes common.

Sermyla halensis, L. On *Galium verum*, &c., in dry places; Tubney, Wytham Park; common in late summer. "Taken in the Botanic garden at Oxford in 1820" (*F. W. H.*).

***Longitarsus holsaticus, L.** In wet places on *Pedicularis palustris;* Cothill, Ogley Bog; common.

L. luridus, Scop. By sweeping, especially in autumn; common.

L. brunneus, Dufts. With the preceding; Tubney, &c., not rare.

****L. agilis, Rye.** On *Scrophularia aquatica* at Cothill; rare.

L. suturellus, Dufts. On *Senecio Jacobæa;* Tubney, Wytham Park, &c., not rare.

L. atricillus, L. By sweeping in woods; Boar's Hill, Tubney, Wytham Park, &c., frequent.

L. melanocephalus, De G. With the preceding species, not rare.

***L. piciceps, Steph.** On *Senecio Jacobæa;* Tubney, Wytham Park; common, autumn.

L. membranaceus, Fond. On *Teucrium Scorodonia;* Boar's Hill, very abundant; also at Tubney.

***L. flavicornis, Steph.** On *Eupatorium cannabinum;* Elsfield, rare.

L. femoralis, Marsh. On *Cynoglossum* and *Echium;* Tubney, Wytham Park; plentiful.

***L. pusillus, Gyll.** On *Thymus serpyllum;* Tubney, Wytham Park, &c.; common.

***L. tabidus, F.** On *Verbascum Thapsus;* Tubney not rare.

L. jacobææ, Wat. On *Senecio Jacobæa;* generally common. The var. **rufescens, Fowler,** frequent at Tubney, &c.

L. ochroleucus, Marsh. By sweeping in waste places; Summertown, occasional.

***L. gracilis, Kuts.** On *Senecio Jacobæa*; Elsfield, Tubney, Wytham Park, &c., common. The var. **poweri, All.** at Tubney (*W. H.*).

L. lævis, Dufts. By sweeping; Chilswell Hills, Tubney (*W. H.*).

***Haltica lythri, Aubé.** On *Epilobium*, *Lythrum salicaria*, &c., in wet places; Ogley Bog, common, South Hinksey, &c.

H. ericeti, All. On *Calluna vulgaris;* Tubney, locally common.

H. coryli, All. On hazel and other shrubs; Bagley Wood, occasional.

H. oleracea, L. On sallows, &c.; Tubney, not common.

H. pusilla, Dufts. Chiefly on *Helianthemum vulgare;* Tubney and Wytham Park; very abundant at Headington Wick Copse, November 24th, 1906.

Hermœophaga mercurialis, F. On *Mercurialis perennis;* Bagley Wood, Tubney, Wytham Park; common.

***Phyllotreta nodicornis, Marsh.** On *Reseda Luteola;* Elsfield, not rare.

P. nigripes, F. Elsfield, on *Reseda* (*J. C.*).

***P. punctulata, Marsh.** Cumnor (*W. H.*).

P. atra, Payk.
P. cruciferæ, Goeze.
P. vittula, Redt.
P. undulata, Kuts.
P. nemorum, L.
All these species are more or less plentiful on Cruciferous plants throughout the district; **P. nemorum** being sometimes too well known as the "Turnip-flea."

***P. ochripes, Curt.** On *Erysimum alliaria;* Marston, Summertown, &c., not rare.

***P. tetrastigma, Com.** This rather conspicuous species was found on *Cardamine amara* at Kirtlington, May 31st, 1906.

P. exclamationis, Thunb. On *Cruciferæ* in wet places; generally distributed and not rare.

***Aphthona lutescens, Gyll.** On *Spiræa ulmaria;* Cothill, Yarnton; locally common.

A. nonstriata, Goeze. On *Iris pseudacorus;* Yarnton, not rare; Cumnor (*W. H.*).

A. venustula, Kuts. On *Euphorbia amygdaloides;* Bagley Wood, Wytham Park; not rare.

A. atrocœrulea, Steph. By sweeping in lanes, &c.; Cothill, frequent.

***A. herbigrada, Curt.** On *Helianthemum vulgare;* Tubney, Wytham Park; common.

***Batophila rubi, Payk.** On brambles; Cothill, frequent.

B. ærata, Marsh. By sweeping under hedges, &c.; generally distributed and not rare.

Sphæroderma testacea, F. On thistles; generally common.

S. cardui, Gyll. Chiefly on *Centaurea;* generally common.

Apteropeda orbiculata, Marsh. By sweeping in woody places, chiefly on *Glechoma hederacea;* widely distributed and not rare.

Podagrica fuscicornis, L. On mallows; generally common. Very destructive to cultivated Malvaceous plants in nursery gardens at Summertown. (Ent. Mo. Mag. 1904, p. 183.)

Mantura rustica, L. By general sweeping, in sandpits, &c.; Cumnor, Elsfield, Tubney, Wytham Park, &c.; not rare.

***M. matthewsi, Curt.** On *Helianthemum vulgare;* Wytham Park, not rare; also at Tubney.

Crepidodera transversa, Marsh.
C. ferruginea, Scop.
Both common by sweeping in grassy places in late summer.

***C. nitidula, L.** On aspens at Bagley Wood, not rare, June 1905 (*J. C.*).

C. helxines, L. On poplars; generally common.

***C. chloris, Foud.** On willows; generally distributed and often common.

C. aurata, Marsh. Chiefly on sallows; generally common.

***C. smaragdina, Foud.** With the preceding species; Cothill; Bagley Wood (*W. H.*).

***Hippuriphila modeeri, L.** On *Equisetum*, and in tufts in winter; Bagley, Chilswell, Ogley Bog; fairly common.

****Epitrix pubescens, Koch.** On *Solanum Dulcamara;* Cothill, rare.

***E. atropæ, Foud.** On *Atropa Belladonna* in summer; Wytham Park, abundant.

***Chætocnema confusa, Boh.** Tubney (*W. H.*).

C. hortensis, Fourc. By general sweeping; fairly common.

Plectroscelis concinna, Marsh. By sweeping, chiefly in damp places; common.

Psylliodes chrysocephala, L. In waste places, on Crucifers, &c.; Shotover; Bagley Wood (*W. H.*); not common.

P. napi, Koch. On aquatic plants, mostly *Cruciferæ;* Marston Ferry, Tubney, &c.; common.

P. cuprea, Koch. By general sweeping; Cothill, Tubney; not rare.

P. affinis, Payk. On *Solanum Dulcamara;* generally common.

***P. chalcomera, Ill.** On *Carduus nutans;* Tubney, common.

****P. hyoscyami, L.** This usually rare species occurs abundantly throughout the summer on *Hyoscyamus niger* at Wytham Park, and has also been taken at Elsfield.

***P. picina, Marsh.** On aquatic plants on river-banks; Marston Ferry, Water Eaton; King's Weir (*W. H.*).

***Cassida murræa, L.** On *Inula dysenterica;* Chilswell Hills, July, 1899, taken sparingly in all its stages by Mr. H. St. J. Donisthorpe and myself, July, 1899, and more freely in succeeding years by Mr. Holland.

***C. vibex, L.** By sweeping at Elsfield, scarce (*W. H.*).

C. nobilis, L. "Taken in 1820 at Oxford on the banks of the Isis on flags" (*F. W. H.*).

C. flaveola, Thunb. By sweeping, in tufts in winter, &c.; Tubney, Yarnton, scarce; Boar's Hill (*W. H.*).

C. equestris, F. On *Mentha*, *Lycopus*, &c., in wet places; Cothill, King's Weir, Marston Ferry, Tubney, &c.; often common.

C. viridis, L. On thistles; common everywhere.

Family **Tenebrionidæ.**

Blaps mucronata, Latr. In houses, cellars, &c.; common.

***Crypticus quisquilius, L.** This usually strictly maritime species has been found locally in sandy places on Frilford Heath by Mr. Holland and myself.

Microzoum tibiale, F. In sandy places; Tubney, common.

***Heledona agaricola, Hbst.** In fungus on dead birch tree, Christ Church Meadow; rare.

***Scaphidema metallicum, F.** One in a tuft at Yarnton, January 5th, 1907; Tubney (*W. H.*).

Tenebrio molitor, L. In houses, Summertown, flying to light; also under bark at Wytham Park.

Tribolium ferrugineum, F. In the Museum buildings, occasional.

***Hypophlæus bicolor, Ol.** Under bark of dead elm; Tubney, not rare.

Helops striatus, Fourc. Bagley Wood, in faggots, not common. "Taken at the roots of trees at Bagley Wood in 1819" (*F. W. H.*).

FAMILY **Lagriidæ.**

Lagria hirta, L. By sweeping under hedges, &c., in summer; common.

FAMILY **Cistelidæ.**

Cistela murina, L. On flowers and by sweeping; early summer, common.

***Cteniopus sulphureus, L.** On *Galium verum*, &c.; Tubney, abundant in July. Usually a coast species.

FAMILY **Melandryadæ.**

***Tetratoma fungorum, F.** In fungi on old trees; Tubney, Wood Eaton; common.

***Conopalpus testaceus, Ol.** By sweeping under trees; Wytham Park, rare.

***Melandrya caraboides, L.** On oak stumps, Bagley Wood (*W. H.*); in old willows at Oxford (*J. W. S.*). "Taken at Oxford in 1820 under the bark of willows, they seem to be fond of basking in the sun" (*F. W. H.*).

FAMILY **Pythidæ.**

***Salpingus castaneus, Panz.** By sweeping under fir-trees; Tubney, Wytham Park; scarce.

***Lissodema 4-pustulata, Marsh.** By sweeping; Summertown, Wytham Park; scarce.

Rhinosimus viridipennis, Steph.
R. planirostris, F.
} In dead sticks and by sweeping; both rather common and widely distributed.

FAMILY **Œdemeridæ.**

Œdemera nobilis, Scop. "Taken at Oxford in 1819" (*F. W. H.*).

Œ. lurida, Marsh. In flowers, early summer; not rare in woody places.

***Oncomera femorata, F.** "A single specimen captured flying in the city" (*J. W. S.*).

***Nacerdes melanura, L.** On walls and palings; occasionally in the City. Much more common on the coast than inland.

***Ischnomera cœrulea, L.** "Rarely on hawthorn in early spring" (*J. W. S.*); "Capt. Bagley Wood, 1819" (*F. W. H.*).

FAMILY **Pyrochroidæ.**

Pyrochroa serraticornis, Scop. On hedges and flowers in early summer; not rare. "Taken in June in 1819 at Oxford on almost every hedge about the City" (*F. W. H.*).

FAMILY **Mordellidæ.**

***Mordella fasciata, F.** On Umbelliferous flowers in July; Wytham Park, fairly common; also at Cothill.

***Mordellistena abdominalis, F.** On hawthorn-blossom; Bagley Wood, Boar's Hill; scarce.

***M. humeralis, L.** ***M. pumila, Gyll.**?	Both occur sparingly on flowers in early summer at Bagley Wood, Boar's Hill, Cothill, &c.

Anaspis frontalis, L. On hawthorn-blossom ; generally common.

***A. garneysi, Fowl.** Bagley Wood (*W. H.*).

A. pulicaria, Costa. **A. geoffroyi, Müll.** **A. costæ, Emery.** **A. subtestacea, Steph.** **A. maculata, Fourc.**	All occur more or less commonly in hawthorn blossom, &c., in early summer, especially in woody places.

Family **Anthicidæ.**

Notoxus monoceros, L. In sandpits, by sweeping, and on the wing ; Cumnor, Tubney, &c. ; sometimes very plentiful. Usually regarded as a coast insect.

Anthicus floralis, L. In vegetable refuse and by sweeping ; common. "Taken at Oxford in 1819, common on stones and posts near stable yards, particularly about horse dung in such situations in Oxford" (*F. W. H.*).

A. antherinus, L. By sweeping ; generally distributed and not rare. "Taken at Oxford in 1819" (*F. W. H.*).

Family **Meloidæ.**

Meloë proscarabæus, L. The Oil-beetle. In grassy places and pathways in spring ; common. "Taken in great numbers in 1819 at the stone quarries at Heddington, feeding on the delicate thin grass" (*F. W. H.*).

M. violaceus, Marsh. Boar's Hill (*W. H.*). "Taken at Oxford in 1819" (*F. W. H.*).

****Sitaris muralis, Forst.** This rare and very interesting beetle has been found not uncommonly in August and September, 1906, by Mr. A. H. Hamm, on old stone walls at Cowley and Iffley, in and about the nests of the mason-bee, *Anthophora pilipes, F.*, on which it is parasitic in its early stages (Ent. Mo. Mag. 1906, p. 273). "On an old wall at Wolvercot" (*J. W. S.*).

Family **Anthribidæ.**

***Brachytarsus fasciatus, Forst.** "Taken at Oxford in 1819 . . . . it is taken on the blossoms of the horse chestnut, in some years in great numbers" (*F. W. H.*).

***B. varius, F.** On hawthorn-blossom and by sweeping ; Bagley Wood, Tubney ; rare.

Family **Curculionidæ.**

***Apoderus coryli, L.** On hazel, Bagley Wood (*W. H.*). "I once took this on my windows in Peckwater at Ch. Ch., Oxford, I have repeatedly taken it" (*F. W. H.*).

Attellabus curculionoides, L. On oak leaves in early summer ; Tubney, scarce.

***Byctiscus betuleti, F.** Bagley Wood (*W. H.*). "Taken at Bagley Wood while beating the Oaks, it varies greatly in colour sometimes being blue and at others of a metallic green" (*F. W. H.*).

***B. populi, L.** "Taken at Oxon in 1819" (*F. W. H.*).

Rhynchites æquatus, L. On hawthorn-blossom; common everywhere. "Taken at Oxford in 1820" (*F. W. H.*).

R. æneovirens, Marsh. By sweeping in woods; Bagley Wood, Tubney, &c., not rare.

R. minutus, Herbst. By general sweeping in early summer; common.

***R. interpunctatus, Steph.** On young hazel and birch; Bagley Wood, Boar's Hill, scarce.

R. nanus, Payk. On young birch trees; Boar's Hill, not rare.

***R. uncinatus, Thoms.** With the preceding species, but rarely.

***R. pubescens, F.** Bagley Wood (*W. H.*). "Taken at Bagley Wood whilst beating Oaks" (*F. W. H.*).

Deporaus megacephalus, Germ. On young birch trees; Boar's Hill, not common.

D. betulæ, L. On young birch trees; widely distributed and not rare.

Apion pomonæ, F. By sweeping; Cothill, Tubney, Wytham Park, &c.; occasional.

A. ulicis, Forst. On furze; generally common.

A. miniatum, Germ. On docks (*Rumex* spp.); generally common.

***A. cruentatum, Walt.** In damp places, by sweeping, and in tufts in winter; Bagley Wood, Ogley Bog, Yarnton, &c.; scarce.

A. hæmatodes, Kirby. On *Teucrium Scorodonia;* often in sandpits; Boar's Hill, Tubney, &c., plentiful.

A. rubens, Steph. By sweeping, chiefly in autumn; Tubney, not rare.

****A. sanguineum, De G.** This usually rare species has been taken in plenty at Tubney by Mr. W. Holland and myself, in sandpits and by sweeping, chiefly in September and October. It appears to be partial to *Gnaphalium sylvaticum.*

***A. pallipes, Kirby.** On *Mercurialis perennis;* Cothill, Wood Eaton, Tubney; fairly common.

A. rufirostre, F. On *Malva sylvestris;* widely distributed and not rare.

A. viciæ, Payk. By sweeping, in tufts, &c.; Ogley Bog, &c., not rare.

A. difforme, Germ. By sweeping in moist places; also in tufts; generally common.

A. varipes, Germ. By sweeping; Cothill, Tubney; not rare.

***A. schonherri, Boh.** This species, usually regarded as rare and chiefly attached to the coast, is plentiful at Tubney by sweeping as well as in tufts of grass in the winter.

A. apricans, Herbst. By general sweeping; fairly common.

A. assimile, Kirby. Tubney (*W. H.*).

A. trifolii, L. By general sweeping in grassy places; common.

A. dichroum, Bedel.
A. nigritarse, Kirby. } Generally common, by sweeping in grassy lanes, &c.

***A. confluens, Kirby.** On *Matricaria inodora;* Boar's Hill, sparingly, July, 1899.

***A. stolidum, Germ.** On *Chrysanthemum Leucanthemum* in flower; Marston Ferry, June, 1906, sparingly.

A. æneum, F.
A. radiolus, Kirby. } These two species are common on *Malva sylvestris,* and generally distributed.

A. onopordi, Kirby.
A. carduorum, Kirby. } Both common and widely distributed throughout the district, on thistles.

****A. lævigatum, Kirby.** Two examples of this very rare and distinct species have been taken at Tubney; one in June, 1903, by Mr. W. Holland, the other (by sweeping) by Mr. H. St. J. Donisthorpe in my company, September 14th, 1905.

***A. vicinum, Kirby.** On *Mentha* in damp places; Cothill, Elsfield, Tubney, Yarnton; not rare.

A. virens, Herbst. By sweeping in grassy lanes, &c.; generally common.

****A. astragali, Payk.** This rare and beautiful species was first found by Mr. W. Holland in August, 1905, on *Astragalus glycyphyllos* near Cumnor, where it is plentiful, but local. It also occurs more sparingly near Ferry Hincksey and Chilswell, and I found it commonly at Kirtlington, May 31st, 1906.

A. pisi, F.
A. æthiops, Kirby. } Both generally common, especially the first-named, on Leguminous plants and by sweeping.

***A. ebeninum, Kirby.** On *Lotus major*, *Vicia Cracca*, &c.; Bagley Wood, Cothill, Shotover, Tubney, &c.; not rare.

***A. filirostre, Kirby.** By general sweeping; Abingdon, Cothill, Wytham Park, Tubney; usually occurs by single specimens.

A. ononis, Kirby. On rest-harrow, generally distributed; abundant at Wytham Park.

***A. spencei, Kirby.** On *Lathyrus*, *Vicia*, &c.; banks of canal near Yarnton, not rare.

A. ervi, Kirby. On Leguminous plants; Cothill, Ogley Bog, Wytham Park, &c., not rare.

A. vorax, Herbst. By sweeping in grassy places; Cothill, Tubney, frequent.

***A. unicolor, Kirby.** Chiefly on *Lathyrus pratensis;* canal banks near Yarnton, not rare.

A. meliloti, Kirby. On *Melilotus officinalis;* Chawley brick-pit, scarce.

A. loti, Kirby. On Leguminous plants; Tubney, Wytham Park, &c.; not rare.

A. seniculum, Kirby.
A. tenue, Kirby. } These two species are found rather commonly by sweeping at Cothill, Wytham Park, &c.

***A. pubescens, Kirby.** By sweeping in autumn; Tubney, scarce.

A. marchicum, Herbst. On *Rumex acetosella* and in sandpits; Boar's Hill, Tubney; very common.

***A. affine, Kirby.** In sandy places, by sweeping; Boar's Hill, rare.

A. violaceum, Kirby. On *Rumex* and by general sweeping; common.

A. hydrolapathi, Kirby. Chiefly on *Rumex hydrolapathum* on river-banks; King's Weir, Marston Ferry, Yarnton, &c.; common.

A. humile, Germ. By sweeping in damp grassy places; abundant everywhere.

Otiorrhynchus tenebricosus, Herbst. "Taken at Oxford under stones in 1819" (*F. W. H.*).

O. scabrosus, Marsh. By sweeping, and in city gardens; not rare.

O. ligneus, Ol. In sandy places; Ogley Bog, Tubney, &c.; common.

O. picipes, F. By sweeping, and in gardens; generally common.

O. sulcatus, F. In gardens; occasional. "Very common at the Botanic garden at Oxford and in places about Oxford" (*F. W. H.*).

O. ovatus, L. In sandy places; sometimes by sweeping; fairly common.

Trachyphlœus scaber, L.
T. scabriculus, L. } Both common at roots of herbage and in sandpits at Shotover, Tubney, and other sandy places.

***T. alternans, Gyll.** By sweeping; Ogley Bog, Wytham Park, sparingly.

Strophosomus coryli, F. By sweeping and beating hazel, &c., in woods; common. "Taken in my rooms at Xst. Church in 1819 crawling on my window" (*F. W. H.*).

S. capitatus, De G. With the preceding species, not rare. The well-marked and scarce var. **fulvicornis, Walt.** occurs at Tubney (*W. H.*).
S. retusus, Marsh. By sweeping; Tubney, not rare. "Taken at Oxford in 1820" (*F. W. H.*).
***S. faber, Herbst.** Under stones and in sandpits; Tubney, sparingly.
S. lateralis, Payk. Under heather on the sand; Tubney, sparingly.
Exomias araneiformis, Schrank. Among dead leaves and sticks; Bagley Wood, Islip, &c.; not rare.
***Brachysomus echinatus, Bonsd.** By sweeping under hedges; Abingdon, Tubney; rare.
Sciaphilus muricatus, F. By sweeping and in moss, especially in woods; not rare.
***Tropiphorus tomentosus, Marsh.** "Taken at Oxford in 1820" (*F. W. H.*).
Liophlœus nubilus, F. Summertown, on paths, scarce. "Taken on the flags that grow in the water down at Iffley and is very abundant there" (*F. W. H.*).
Polydrusus tereticollis, De G.
P. pterygomalis, Sch.
P. cervinus, L. } On young trees in woods; all common in early summer.
Phyllobius oblongus, L. By sweeping and beating in early summer; common. "Very commonly taken in May in beating oaks, taken at Oxford in 1819." (*F. W. H.*).
***P. calcaratus, F.** By sweeping in damp places; Cothill, not rare; Bagley Wood (*W. H.*).
P. urticæ, De G. On nettles, especially in damp places; abundant in early summer.
P. pyri, L. On young trees and by sweeping; generally common.
P. argentatus, L.
P. maculicornis, Germ.
P. viridiæris, Laich. } These three species are plentiful, especially in woods and lanes, in early summer.
Barynotus obscurus, F. In tufts and under stones; Summertown, Tubney; not rare.
***B. elevatus, Marsh.** By sweeping and in tufts; Bagley Wood, Cumnor; scarce.
Alophus triguttatus, F. "Taken in 1820 in great numbers in the roadway thro' Lord Abingdon's grounds at Witham" (*F. W. H.*).
Sitones griseus, F. By sweeping; Tubney, frequent. Usually a coast species.
***S. cambricus, Steph.** On *Lotus major*; Bagley Wood, not rare.
S. regensteinensis, Herbst. On broom; Chawley brick-pit, not rare.
S. crinitus, Herbst. By sweeping and in sandpits; Cothill, Tubney; frequent.
S. tibialis, Herbst. On Leguminous plants; generally distributed and not rare.
S. hispidulus, F. By sweeping, on walls, in sandpits, &c.; very common.
S. humeralis, Steph. By sweeping and in sandpits; Cothill, Tubney; not rare.
***S. meliloti, Walt.** On *Melilotus officinalis*; Chawley brick-pit, scarce.
S. flavescens, Marsh.
S. puncticollis, Steph. } These two species are generally distributed and not rare by sweeping, especially in autumn.
S. suturalis, Steph. Boar's Hill (*C. E. Collins*).
S. lineatus, L. On Leguminous plants; abundant everywhere.
S. sulcifrons, Thunb. On *Lotus*, *Lathyrus*, &c.; Wytham Park; not rare.
***Gronops lunatus, F.** In sandy places; Tubney, scarce; Bagley Wood (*W. H.*).

Hypera punctata, F. In sandpits and by sweeping; Cothill, Cumnor; scarce.

H. rumicis, L. On *Rumex* in damp places; not uncommon and widely distributed.

H. polygoni, L. In sandpits; sometimes in tufts; Ogley Bog, Tubney, &c., frequent.

***H. suspiciosa, Herbst.** In tufts of grass at Yarnton; rare.

H. variabilis, Herbst. By sweeping, in sandpits, &c.; generally common.

H. plantaginis, De G. In sandpits and by sweeping; Ogley Bog, Tubney, &c.; not rare.

H. trilineata, Marsh. By sweeping; Tubney, rather scarce.

H. nigrirostris, F. By sweeping, in moss, &c.; generally common.

***Cleonus sulcirostris, L.** This large and conspicuous weevil is at times fairly common at the roots of thistles in sandy places at Boar's Hill and Tubney; the specimens from the first-named locality being usually of a strong reddish tint corresponding to that of the sand on which they are found. "Taken at Oxford going up to Bullington near the cricket ground in the pathway in 1819" (*F. W. H.*).

***Lixus paraplecticus, L.** "Taken at Oxford in 1825 on Flags, and altho' longer than angustata [*algirus*, L.] which abounds at Bossom's on the Banks of the Isis, I yet think it is only a Variety" (*F. W. H.*).

****L. algirus, L.** "Taken near Bossom's on the Banks of the Isis in great numbers, crawling up flags, rushes, and water plants" (*F. W. H.*).

Liosoma ovatulum, Clairv. At roots of herbage in damp places; King's Weir, Marston Ferry, Yarnton, &c.; not rare. The var. **collaris, Rye,** has occurred at Bagley Wood.

Orchestes quercus, L. On oaks, and by sweeping; generally common in woods.

***O scutellaris, Gyll,** var. **semirufus, Gyll.** "Taken at Oxford in 1820" (*F. W. H.*).

O. alni, L. On and about elm trees; very common; the var. **ferrugineus, Marsh.,** of frequent occurrence.

O. ilicis, F. By sweeping in woods; Tubney, Wytham Park; not rare.

O. avellanæ, Don. On hazel, birch, &c.; Bagley Wood, Wytham Park; frequent.

O. fagi, L. On and about beech trees; Wytham Park, common.

O. rusci, Herbst. In woods, by sweeping; Bagley Wood, Wytham Park; occasional.

O. stigma, Germ. On sallows; Cothill, King's Weir, Yarnton; common.

O. salicis, L. With the preceding species; not rare.

***O. saliceti, F.** On small willows on river-bank, Godstow; common.

Rhamphus flavicornis, Clairv. By sweeping under hedges; generally common.

***Orthochætes setiger, Beck.** In moss and at roots of ragwort; Tubney, scarce.

***Erirrhinus bimaculatus, F.** In wet tufts of grass; near Wytham Park, rare.

E. acridulus, L. In damp places; common and generally distributed.

***Thryogenes festucæ, Herbst.** In tufts and by sweeping on river-banks; King's Weir, Marston Ferry; sparingly.

***T. nereis, Payk.** In damp tufts of grass; Yarnton, not common.

***T. scirrhosus, Gyll.** By sweeping at Cothill; one example, June, 1906.

***Dorytomus vorax, F.** On poplars, and under their bark in winter; Bagley Wood, not rare; near Wytham Park (*J. C.*); Iffley (*J. W. S.*).

D. tortrix, L. On poplars and aspens; Bagley Wood, not rare.

D. maculatus, Marsh. On sallows, especially in spring; common.

*D. melanophthalmus, Payk., var. agnathus, Boh. On sallows near Ferry Hinksey, scarce, June, 1904.

*D. pectoralis, Gyll. With the preceding, and near Marston Ferry; sparingly.

Tanysphyrus lemnæ, F. Among duckweed and in flood-refuse; Wytham Park, Yarnton; common.

Anoplus plantaris, Næz. On young birch trees; Bagley Wood, Boar's Hill, Tubney; not rare.

*Elleschus bipunctatus, L. On sallows in Hen Wood; locally frequent in spring.

*Tychius tibialis, Boh. By sweeping; Cothill, Tubney; not rare.

Miccotrogus picirostris, F. By sweeping under hedges, &c.; generally common.

*Sibinia primita, Herbst. On *Spergula arvensis* and by general sweeping; Cothill, Tubney; scarce.

*Miarus campanulæ, L. Boar's Hill (*W. H.*).

*M. plantarum, Germ. By sweeping in lanes, &c.; Cothill, Cumnor, Tubney, Yarnton; sparingly.

*Gymnetron villosulus, Gyll. By sweeping in damp places; Marston Ferry, rare.

*G. beccabungæ, L. On *Veronica Anagallis* and *V. Beccabunga* in wet places; Islip, Marston Ferry, Summertown, &c.; not rare.

G. antirrhini, Payk On *Linaria vulgaris;* Tubney, sometimes common.

Mecinus pyraster, Hbst. By general sweeping; widely distributed and common.

Anthonomus ulmi, De G. By sweeping; Wytham Park, rare.

A. pedicularius, L. On hawthorn-blossom in woods; common in early summer.

A. rubi, Herbst. By general sweeping; very common; varies greatly in size.

Nanophyes lythri, F. On *Lythrum salicaria;* Cothill, Marston, Yarnton; not rare.

Cionus scrophulariæ, L. On *Scrophularia aquatica;* generally common. "Taken at Oxford in 1820" (*F. W. H.*).

C. hortulanus, Marsh. On *Scrophularia* and *Verbascum;* Bagley Wood, Tubney; frequent. "Taken at Oxford in 1820" (*F. W. H.*).

C. blattariæ, F. On *Scrophularia aquatica;* generally common.

C. pulchellus, Herbst. On *Scrophularia,* chiefly in woods; Bagley Wood, Tubney; common.

*Orobitis cyaneus, L. By sweeping in woods; Tubney, Wytham Park; scarce.

Acalles ptinoides, Marsh. Among dead sticks, &c.; Bagley Wood, Elsfield, Islip, Tubney; frequent.

Cœliodes rubicundus, Herbst. On young trees in woods; occasional.

C. quercus, F. By beating young oaks, &c., in woods; Bagley Wood, Boar's Hill, Tubney; not rare.

C. ruber, Marsh.
C. erythroleucus, Gmel. } These two species are not rare by beating young trees in early summer; Bagley Wood, Boar's Hill, Tubney.

C. cardui, Herbst. In sandpits and by sweeping; Cothill, Tubney, Yarnton; frequent.

C. quadrimaculatus, L. On nettles; abundant everywhere.

*C. exiguus, Ol. On *Geranium pyrenaicum;* locally common near Tubney.

*Poöphagus sisymbrii, F. On water-cress in damp places; Marston Ferry, Yarnton; not common.

Ceuthorrhynchus assimilis, Payk. On *Cruciferæ;* generally common.

*C. **setosus, Boh.** By sweeping and in sandpits in spring; Cothill, Tubney; scarce.
*C. **cochleariæ, Gyll.** On *Cardamine pratensis;* Marston Ferry, scarce.
C. **ericæ, Gyll.** On *Calluna vulgaris;* Tubney, not rare.
C. **erysimi, F.** On *Sisymbrium* and other Cruciferous plants; generally common.
C. **contractus, Marsh.** On Cruciferous plants and by general sweeping; very common.
C. **chalybæus, Germ.** On Cruciferous plants in damp places; Ogley Bog, Tubney; not rare.
C. **quadridens, Panz.** On Cruciferous plants; generally common.
*C. **geographicus, Goeze.** This handsome insect is sometimes plentiful at Tubney on the Viper's Bugloss, *Echium vulgare.*
C. **pollinarius, Forst.** On nettles; common, especially in spring. "Taken at Oxford in 1820 by Baxter of the Botanic Garden" (*F. W. H.*).
C. **viduatus, Gyll. On *Stachys palustris;* banks of Cherwell near Water Eaton, rare, July, 1906; also singly on the river-bank near Godstow.
C. **pleurostigma, Marsh.** On Cruciferous plants and by sweeping; very common.
*C. **alliariæ, Bris.** On *Erysimum Alliaria* in spring; Summertown, Marston Ferry, scarce.
*C. **resedæ, Marsh.** On *Reseda Luteola;* Elsfield, locally common in early summer.
C. **marginatus, Payk.** By general sweeping; Cothill, Tubney; not common.
C. **rugulosus, Herbst.** By sweeping at Cothill; rare, spring, 1906.
*C. **melanostictus, Marsh.** On *Lycopus europæus* in damp places; Cothill, Marston Ferry, Wytham, Yarnton; fairly common.
*C. **asperifoliarum, Gyll.** On *Echium* and *Lycopsis;* Elsfield, Tubney; not rare.
C. **euphorbiæ, Bris. In sandpits, chiefly in autumn; Tubney, rare.
*C. **chrysanthemi, Germ.** On *Chrysanthemum Leucanthemum;* Marston Ferry, common; also at Bagley Wood, Cothill, and Wytham.
C. **litura, F.** On thistles; generally distributed and not rare.
Ceuthorrhynchidius floralis, Payk. On *Cruciferæ;* generally common.
C. **pyrrhorhynchus, Marsh.** On *Sisymbrium officinale;* near Walton Bridge, not rare.
*C. **nigrinus, Marsh.** By sweeping; Wytham Park, occasional.
*C. **melanarius, Steph.** On water-cress; King's Weir, Marston Ferry, Summertown, &c.; not rare.
*C. **terminatus, Herbst.** On wild carrot (*Daucus Carota*) near Cothill; scarce.
*C. **horridus, F.** On thistles, chiefly *Carduus nutans;* Tubney, not rare.
C. **troglodytes, F.** By general sweeping; common. "Taken at Oxford in 1820" (*F. W. H.*).
Amalus hæmorrhous, Herbst. By sweeping in lanes, &c.; widely distributed and not rare.
Rhinoncus pericarpius, L. In damp places, by sweeping, &c.; generally common.
*R **gramineus, F.** On *Polygonum* at Marston Ferry, common; also at Wood Eaton.
R. **perpendicularis, Reich.** On *Polygonum* in damp places; widely distributed and not rare.
R. **castor, F.** In dry sandy places; Boar's Hill, Cumnor, Tubney; common.

*Eubrychius velatus, Beck. By sweeping water-plants, Marston Ferry; one specimen, July 5th, 1906.

Litodactylus leucogaster, Marsh. In flood-refuse; Yarnton, rare, spring, 1906.

*Phytobius comari, Herbst. On *Lythrum Salicaria, &c.*: Marston Ferry, not rare, July, 1906.

*P. 4-tuberculatus, F. By sweeping, often far from water; Cothill, Cumnor, Tubney, Wytham Park, &c.; frequent.

*Limnobaris t-album, L. By sweeping in damp places; Cothill, common; also at Ogley Bog and Marston Ferry.

*Baris lepidii, Germ. In flood-refuse near Yarnton, rare, January, 1906.

Balaninus venosus, Grav. On oak, hawthorn-blossom, &c., in woods; fairly common. "Taken at Bagley Wood, Oxfordshire, beating oaks; it is abundant about May" (*F. W. H.*).

B. nucum, L. The "Nut weevil." On hazel; Bagley Wood, Tubney; occasional.

*B. villosus, F. On oak, hawthorn-blossom, &c.; Bagley Wood, Boar's Hill, Tubney; fairly common.

B. salicivorus, Payk. On willows in summer; generally common.

B. pyrrhoceras, Marsh. With the preceding species; frequent.

Calandra granaria, L. About bakers' shops, granaries, &c.; frequent.

C. oryzæ, L. Not as common as the preceding species. "Taken at the Botanic garden at Oxford by Baxter" (*F. W. H.*).

*Cossonus ferrugineus, Clairv. Taken in great abundance in a dead poplar tree at Binsey by Mr. W. Holland, also at South Hinksey. I have found dead specimens in a Lombardy poplar near Wytham Park. "Taken at Oxford on the dry wood of willow trees where the bark had been stripped, it then perforates the wood and commits the greatest havoc" (*F. W. H.*).

Rhyncolus lignarius, Marsh. In decayed wood, chiefly of elm; generally common.

Magdalis armigera, Fourc. On elm hedges; Cothill, occasional; Botley (*W. H.*).

M. cerasi, L. By sweeping; Bagley Wood (*W. H.*); Tubney (*J. C.*).

Family Scolytidæ.

Scolytus destructor, Ol. Very destructive in the larva state to elm trees; the perfect insect occasionally taken by sweeping.

S. multistriatus, Marsh. By sweeping; Marston Ferry, Summertown, &c.; rare.

Hylastes ater, Payk. By sweeping under fir trees; Tubney, frequent.

H. opacus, Er. On old timber, and flying; Summertown, occasional.

*Hylastinus obscurus, Marsh. In old stumps of broom; Chawley brick-pit, rare.

*Hylesinus crenatus, F. Not as yet taken in the perfect state, but the traces of the larva are very frequent in old ash trees.

*H. oleiperda, F. By sweeping under ash trees; Cothill, Tubney; rare.

H. fraxini, Panz. By sweeping; Wytham Park, fairly common.

Myelophilus piniperda, L. By sweeping under fir trees; Tubney, frequent.

*Phlœophthorus rhododactylus, Marsh. In dead stems of broom; Chawley brick-pit, common, May, 1906.

Dryocætes villosus, F. Under oak bark; Wytham Park, not common.

The table on the next page will show at a glance the number of genera and species, in each of the primary divisions of the *Coleoptera* according to the classification of the great French Entomologist Latreille, that are enumerated in the foregoing List as having been found in our District, and also the proportion they bear to the total number recognised as occurring in the British Islands. A comparison with the enumeration of the *Coleoptera* of the much more favourably situated Rochester district may be not uninteresting.

During the time that this list has been passing through the press, several additional species of *Coleoptera* of very great interest have been taken in our District by searching the subterranean nests of the mole (*Talpa europæa*). This method of collecting, first indicated by Dr. N. H. Joy of Bradfield, Berks, in the Entomologists' Monthly Magazine for 1906 (vol. xlii., pp. 198—202, and 237-8), has brought to light several species quite new to the British beetle-fauna, and others hitherto regarded as among our greatest rarities have been found in fair abundance in many localities. Besides those enumerated below, *Heterothops nigra*, Kr. occurs in a large proportion of the nests examined, and the exceedingly rare *Medon castaneus*, Grav. has been taken by me at Shotover Hill, and by Mr. A. H. Hamm at Ogley Bog. The following are not included in the Synoptical table.

Aleochara spadicea, Er. Shotover; Wood Eaton (*J. C.*); Ogley Bog (*A. H. H.*).
Oxypoda metatarsalis, Thoms. Wytham; Wood Eaton (*J. C.*).
Homalota paradoxa, Rey. Wytham; Wood Eaton (*J. C.*).
Quedius vexans, Epp. Wytham, Yarnton; Wood Eaton (*J. C.*); Ogley Bog (*A. H. H.*).

This and the two preceding species are among the most recent additions to the British list.

Q. longicornis, Kr. Wytham; Wood Eaton (*J. C.*), Ogley Bog (*A. H. H.*). Mr. Holland has also taken a single specimen at Shotover Hill on September 24th, 1898.
Hister marginatus, Er. Shotover Hill; two examples, March 2nd, 1907.

8th March, 1907.

Synoptical Table of Coleoptera observed in the Oxford District.

Section.	Families.	No. of British.		Oxford, 7 mile radius.		Percentage of		Rochester, 6 mile radius, 1899.	
		Genera	Species	Genera	Species	Genera	Species	Genera	Species
GEODEPHAGA	**Cicindelidæ and Carabidæ**	64	316	42	159	65·6	50·3	41	145
HYDRADEPHAGA	**Haliplidæ to Gyrinidæ** ...	23	131	16	49	69·5	37·4	14	40
PHILHYDRIDA	**Hydrophilidæ**	24	98	17	43	70·8	43·9	18	47
BRACHELYTRA	**Staphylinidæ**	133	793	80	294	60·1	36·8	93	383
NECROPHAGA (including TRIMERA) ...	**Leptinidæ to Heteroceridæ**	192	685	120	269	62·5	38·9	119	324
LAMELLICORNES	**Lucanidæ and Scarabeidæ**	27	86	16	45	59·2	52·3	18	47
STERNOXI	**Buprestidæ to Elateridæ** ...	25	78	18	38	72·0	48·7	13	28
MALACODERMATA	**Dascillidæ to Cissidæ**	61	153	32	64	52·4	41·8	36	82
LONGICORNIA	**Prionidæ to Lamiidæ** ...	30	55	16	23	53·3	41·8	16	25
PHYTOPHAGA	**Bruchidæ and Chrysomelidæ**	48	256	41	139	85·4	54·2	38	148
HETEROMERA	**Tenebrionidæ to Stylopidæ**	64	128	30	42	46·8	32·8	34	61
RHYNCHOPHORA	**Anthribidæ, Curculionidæ, and Scolytidæ** ...	121	515	69	234	57·0	45·4	81	285
	Total	812	3294	497	1399	61·2	42·5	521	1615

J. J. WALKER.

FIRST SUPPLEMENT

TO THE

PRELIMINARY LIST

OF

COLEOPTERA

IN THE

REPORT FOR 1906,

BY

JAMES J. WALKER,

Hon. M.A., R.N., F.L.S.,

Secretary of the Entomological Society of London.

[*Reprinted from the Ashmolean Natural History Society Report for 1907.*]

FIRST SUPPLEMENT

TO THE

PRELIMINARY LIST OF THE COLEOPTERA OF THE OXFORD DISTRICT,

Published in the Report of the Ashmolean Natural History Society of Oxfordshire for 1906.

By JAMES J. WALKER, Hon M.A., R.N., F.L.S.

THE past year of grace 1907, although it left so much to be desired from a meteorological point of view, has proved to be by no means one of the worst for Insects in general, and for *Coleoptera* in particular. This is evident from the fact that in the following Supplement I am able to add the very satisfactory number of 183 species to the list of this Order of Insects occurring within a radius of about seven miles from the City of Oxford, which was published in our Report for last year. It is true that a considerable number of these additions are species of wide distribution and common occurrence in the British Isles, which might reasonably be expected to occur in our District, but of which we had no definite record when the first list was compiled; but among the remainder are very many forms of great interest, and of more or less local distribution, and several which rank at present among the greatest of our rarities.

Besides these additions to our List, new localities have been found for a large number of our less common beetles, and many rare and local species have been taken, some of which are recorded in the volume of the "Entomologist's Monthly Magazine" for last year. My colleagues in the Hope Department of the Oxford University Museum, Messrs. Holland, Hamm, and Collins, have contributed a large number of the additional species, which, as before, are indicated by their respective initials. Mr. Collins especially has devoted a great deal of time and attention to the *Staphylinidæ*, and especially to the interesting little group of species, mostly belonging to that family, which are associated with the Wood Ant, *Formica rufa*. The result of his industry

is evident from the large number of additions to that numerous and difficult family of beetles which stand to his credit in the following list, and in the determination of many of these I have had the benefit of the expert knowledge of my friend, Mr. G. C. Champion. Mr. H. St. J. Donisthorpe has supplied the names of several species found by him in past years near Oxford, which were omitted by an oversight from the List of Coleoptera in the Society's report for 1906; and several rarities were added by the late Mr. A. J. Chitty, and by Prof. T. Hudson Beare, in flying visits made to Oxford during 1907.

I take the opportunity of correcting one or two errors in the Preliminary List :—

Bembidium minimum, F. (p. 57). The small *Bembidium* recorded under this name, which is so abundant in damp places and flood-refuse throughout the District, is *B. gilvipes*, Sturm.

Helophorus brevicollis, Thoms. (p. 60). This species is inserted in error, the specimens being *H. affinis*, Marsh.

Heterocerus marginatus, F. (p. 78). This should be *H. lævigatus*, Panz., a closely allied species; both are frequently found together on the Coast.

Phyllodecta (Phratora) vulgatissima, L. (p. 87). Most of the local specimens referred to this species appear to belong to the less common *P. cavifrons*, Thoms.

ORDER COLEOPTERA.

Family Carabidæ.

*__Dyschirius politus, Dej.__ One example, Shotover, on a path, April 1907 (*A. H. H.*).

*__Acupalpus consputus, Dufts.__ By sweeping on the roadside near Bletchington; one example, 8th May, 1907.

**__Harpalus obscurus, Fab.__ This fine and rare species was first taken by my nephew, H. G. Champion, under stones at Gibraltar Quarries, April 25th, 1907, and subsequently rather freely at and near the same place by Mr. J. Collins.

*__H. rupicola, Sturm.__ Under stones in quarry at Ogley Bog (*W. H.*); found in plenty at Gibraltar Quarries, April, 1907.

[*__H. parallelus, Dej.__ A small *Harpalus*, taken by Mr. W. Holland and myself in company with *H. rufibarbis*, is perhaps referable to this usually coast-frequenting species.]

H. attenuatus, Steph. Tubney (*H. St. J. Donisthorpe*).

Bembidium nitidulum, Marsh. On walls in spring; Oxford, rare.

*__B. affine, Steph.__ In a damp place, Gibraltar Quarries; one, April 25th, 1907.

Metabletus obscuroguttatus, Dufts. In dry tufts, at roots of elms, &c.; Water Eaton, common (*J. C.*).

Family Haliplidæ.

*__Brychius elevatus, Panz.__ Adhering to stones, sticks, &c., in Bayswater Brook, near Elsfield; scarce, June, 1907.

Family Dytiscidæ.

Laccophilus interruptus, Panz. In running and stagnant water; generally common.

FAMILY Gyrinidæ.

***Orectochilus villosus, Müll.** In company with *Brychius elevatus* in Bayswater Brook; sparingly, June, 1907.

FAMILY Hydrophilidæ.

Anacæna bipustulata, Steph. In wet places; Wood Eaton (*W. H.*).
***Helophorus dorsalis, Marsh.** By sweeping at Wytham Park; one, 22nd April, 1907.
***H. mulsanti, Rye.** Yarnton (*W. H.*).
***Hydrochus elongatus, Schall.** By sweeping on banks of Cherwell; one, May 6th, 1907.

FAMILY Staphylinidæ.

****Aleochara maculata, Bris.** One example of this rare and distinct species taken in a tuft of grass at Hen Wood, March 16th, 1907.
****Oxypoda spectabilis, Bris.** In moles' nests at Wytham; three examples, 23rd March, 1907 (*J. C.*).
O. formiceticola, Märk. In nests of the wood-ant (*Formica rufa*, L.) at Tubney; November, 1907, not rare (*J. C.*).
****O. misella, Kr.** One example at Tubney, in rabbit-burrow, 7th August, 1907 (*J. C.*).
Thiasophila angulata, Er. In nests of *Formica rufa* at Tubney; November, 1907, not rare (*J. C.*).
Ischnoglossa prolixa, Gr. Under bark of oak and ash; Wytham Park, sparingly.
Phlœopora reptans, Grav. In tree fungus, Wytham, scarce, September, 1907 (*J. C.*).
****Calodera umbrosa, Er.** By sweeping at Cothill; one example, 25th May, 1907.
Myrmedonia humeralis, Gr. In nest of *Formica rufa*; Tubney, 9th February, 1908 (*J. C.*).
***Atemeles emarginatus, Payk.** This curious beetle has been taken rather freely by Mr. A. H. Hamm in nests of the ant, *Myrmica rubra*, under stones on Shotover Hill, April and May, 1907. I have found it in Bagley Wood with the same ant, and by sweeping at Headington Wick Copse, 27th June, 1907.
Thamiaræa cinnamomea, Gr. Taken at *Cossus*-burrows at Cowley by Mr. Donisthorpe, and at Summertown by Mr. J. Collins.
Notothecta flavipes, Gr. In nests of *Formica rufa* at Tubney; not rare (*A. H. H.* and *J. C.*).
N. anceps, Er. With the preceding, fairly common (*J. C.*).
Homalota elongatula, Gr. In damp tufts, &c., at Yarnton: not rare.
H. volans, Scriba. On walls, chiefly in early spring; not rare.
H. fungivora, Thoms. In decaying fungi; Wytham Park, &c., occasional.
H. nigella, Er. In moss, damp tufts, &c.; Yarnton, not rare, spring, 1907.
***H. linearis, Grav.** In dead sticks, Tubney and Wytham; occasional (*J. C.*).
***H. debilis, Er.** In moss and damp tufts; Yarnton, occasional.
****H. laticeps, Thoms.** One example of this very rare species taken by the late Mr. A. J. Chitty by sweeping at Cothill, 30th September, 1905.

**H. hepatica, Er. Shotover Hill, one example, 21st May, 1907 (*A. J. Chitty*).

H. xanthopus, Thoms. Tubney, &c., by sweeping; occasional.

H. triangulum, Kr. In flood-rubbish; Water Eaton, rare (*J. C.*).

H. fungicola, Thoms. In rotten fungi, &c.; generally common.

H. nigricornis, Thoms. On walls in spring; occasional.

*H. corvina, Thoms. In dry fungus on trees at Besselsleigh; not rare, 28th September, 1907 (*J. C.*).

*H. atomaria, Kr. By sweeping at Wytham Park; rare, September, 1907.

**H. testaceipes, Heer. By sweeping under trees in early summer; Elsfield, Tubney, rare.

H. inquinula, Er. In dung; Water Eaton, occasional (*J. C.*).

H. nigra, Er. In vegetable refuse; Tubney, Wytham, &c., frequent (*J. C.*).

H. cauta, Er. In dung; Tubney, 30th March, 1907 (*J. C.*).

H. longicornis, Grav. In dung, vegetable refuse, and on walls; generally common.

H. sordida, Marsh. In flood-rubbish; Water Eaton, &c. (*J. C.*).

*H. testudinea, Er. In dung; Elsfield, Water Eaton, &c., not rare (*J. C.*).

H. aterrima, Grav. In dung, &c.; Wytham, Water Eaton (*J. C.*).

H. laticollis, Steph. In moss, vegetable refuse, &c.; generally common.

H. fungi, Grav. var. clientula, Er. This well-marked form is common in fungus, &c., at Tubney, Wood Eaton, and elsewhere (*J. C.*).

*Gyrophæna lucidula, Er. In damp dead sticks at Yarnton; a few, April, 1907.

Tachyporus solutus, Er. Yarnton (*W. H.*).

**Tachinus scapularis, Steph. By sweeping at Summertown; one example, 20th June, 1907.

*Mycetoporus clavicornis, Steph. Taken by Mr. H. St. J. Donisthorpe.

*Quedius microps, Grav. In decayed wood of a hollow elm tree on the Cherwell bank near Summertown; several examples, early spring, 1907.

**Q. ventralis, Ahr. One specimen of this fine species taken under bark on an old post at Chilswell Farm by the late Mr. M. Jacoby, 23rd April, 1907.

*Q. brevis, Er. In nests of *Formica rufa* at Tubney; not rare, June, 1907 (*J. C.*).

Ocypus brunnipes, Fab. In tufts and under stones; Wood Eaton, sparingly (*J. C.*).

*Philonthus addendus, Sharp. One example, in tree-fungus at Besselsleigh, 28th September, 1907, appears to be referable to this species.

*P. albipes, Grav. Taken by Mr. Donisthorpe.

P. cephalotes, Grav. In manure-heaps, &c.; Yarnton, Wood Eaton, occasional.

**P. fuscus, Grav. One example in tree-fungus at Wytham, 15th September, 1907 (*J. C.*).

P. longicornis, Steph. In dung; Elsfield, &c., not rare (*J. C.*).

P. agilis, Grav. In dung; Water Eaton, sparingly (*J. C.*).

*P. nigritulus, Grav. In refuse of faggot-stack, Tubney, June, 1907, not rare; also in dung at Water Eaton (*J. C.*).

*Xantholinus atratus, Grav. In nests of *Formica rufa* at Tubney; sparingly, September, 1907 (*J. C.*).

Leptacinus parumpunctatus, Gyll.
L. batychrus, Gyll.
These two species occur occasionally on walls and in manure-heaps at Summertown, Yarnton, &c.

L. formicetorum, Märk. In nests of *Formica rufa* at Tubney; common (*J. C.*).

Medon melanocephalus, Fab. Tubney and Bagley (*W. H.*).

Stenus canaliculatus, Gyll. Medley (*W. H.*).

***S. vafellus, Er.** In wet places; Yarnton, Beckley (*W. H.*).

S. crassus, Steph. In moss, &c.; Yarnton, sparingly.

S. carbonarius, Gyll. In flood-rubbish at Water Eaton, 29th December, 1907 (*J. C.*).

S. nigritulus, Gyll. Wood Eaton and Cassington (*W. H.*).

S. nitidiusculus, Steph. Ogley Bog (*W. H.*).

***S. solutus, Er.** Otmoor (*W. H.*).

S. latifrons, Er. In wet tufts of grass; Yarnton; Wytham (*J. C.*).

****Platystethus alutaceus, Thoms.** In a tuft at Yarnton; one example, 18th April, 1907.

***Oxytelus insecatus, Grav.** Under stones at Gibraltar Quarries; rare.

O. inustus, Grav. In dung; generally common.

****O. fairmairei, Pand.** This hitherto rare little species has been taken not uncommonly in moles' nests throughout the district by Mr. J. Collins and myself.

Trogophlœus rivularis, Mots. Taken by Mr. Donisthorpe; apparently not rare.

T. elongatulus, Er. On river-banks, edges of ponds, &c.; fairly common.

T. corticinus, Grav. In flood-rubbish at Water Eaton, 29th December, 1907 (*J. C.*).

***Syntomium æneum, Müll.** By sweeping on the roadside near Elsfield; one example, 17th June, 1907.

****Acidota cruentata, Mann.** One example of this rare species taken by Mr. Donisthorpe in my company, by sweeping at Wytham Park, 8th November, 1907.

***Homalium allardi, Fairm.** In manure-heap near Yarnton; one example, 27th February, 1907.

****H. exiguum, Gyll.** In dead rabbit at Tubney, one, 25th May, 1907; also by sweeping at Summertown, one, 7th June, 1907.

FAMILY Clambidæ.

Clambus minutus, Sturm. In garden refuse at Summertown; common.

FAMILY Silphidæ.

****Anisotoma curta, Fairm.** One female example of this exceedingly rare species taken by sweeping under fir trees at Tubney, 19th October, 1907.

****Agaricophagus cephalotes, Schaum.** By sweeping at Wytham Park; one example, 13th September, 1907 (*H. St. J. Donisthorpe*).

FAMILY Pselaphidæ.

****Pselaphus dresdensis, Herbst.** In dead leaves at Yarnton; one example, 24th April, 1907.

FAMILY Corylophidæ.

Sericoderus lateralis, Gyll. In garden refuse; Summertown, &c., not rare.

Family **Phalacridæ.**

Olibrus liquidus, Er. Taken by Mr. Donisthorpe; not rare by sweeping at Tubney, &c.

Family **Histeridæ.**

***Hister merdarius, Hoff.** In starling's nest in hollow elm near Water Eaton; three examples, May and August, 1907 (*J. C.*).

H. carbonarius, Ill. In dung; Water Eaton, Tubney, &c., not rare (*J. C.*).

***Myrmetes piceus, Payk.** In nests of *Formica rufa* at Tubney; rare, late autumn, 1907 (*J. C.*).

***Acritus nigricornis, Hoff.** By sweeping at Wytham Park; one example, 19th September, 1907.

Family **Nitidulidæ.**

***Nitidula quadripustulata, Fab.** Found commonly at Headington Wick Copse in a sheep's skull along with *N. rufipes*, June, 1907; also singly by sweeping at Cothill.

Soronia punctatissima, Ill. Taken by Mr. Donisthorpe at Cowley; also at sap of *Cossus*-infested oak near Summertown, July, 1907 (*J. C.*).

***Meligethes umbrosus, Sturm.** Shotover (*W. H.*).

M. obscurus, Er. Shotover (*W. H.*), Tubney (*J. C.*).

***M. solidus, Sturm.** On flowers of *Helianthemum vulgare;* Wood Eaton and Tubney, not rare (*J. C.*); Shotover (*W. H.*).

***Cryptarcha imperialis, F.** At sap of *Cossus*-oak near Summertown; one, 14th July, 1907 (*J. C.*).

***Rhizophagus cribratus, Gyll.** By sweeping at Tubney; one example, 8th June, 1907.

Family **Monotomidæ.**

***Monotoma conicicollis, Aubé.**
***M. formicetorum, Thoms.** } Not uncommon in nests of *Formica rufa* at Tubney, November, 1907 (*J. C.*).

Family **Lathridiidæ.**

****Holoparamecus depressus, Curt.** Mr. J. R. le B. Tomlin, of Reading, informs me that he has specimens of this rare insect labelled "Oxford, common, 1891." They were probably taken by the late Mr. J. W. Shipp.

Family **Cucujidæ.**

***Læmophlœus ater, Ol.** In dead broom-stump at Chawley, with *Phlœophthorus rhododactylus*, Marsh.; one example, 19th April, 1907.

Family **Cryptophagidæ.**

Cryptophagus lycoperdi, Herbst. In garden, Observatory St., Oxford (*W. H.*).

****C. ruficornis, Steph.** Under decayed ash bark, Wytham Park; one example, 22nd April, 1907.

C. distinguendus, Sturm. In window of house, Oxford (*W. H.*).

C. acutangulus, Gyll. In manure-heap, Yarnton; rare, March, 1907.

C. affinis, Sturm. In cellar of house, Oxford (*W. H.*).

****Cænoscelis pallida, Woll.** By sweeping at Tubney; one example, 8th June, 1907.

Atomaria fuscata, Sch. Chilswell and Wood Eaton (*W. H.*)
A. analis, Er. Oxford City (*W. H.*).
****Ephistemus globosus, Waltl.** In tufts of grass; Yarnton, 18th April, and Radley, 27th April, 1907, singly.

Family Dermestidæ.

[**Dermestes vulpinus, F.** An entry in the Rev. F. W. Hope's interleaved copy of Marsham's "Entomologia Britannica," vol. I., opposite p. 61, under *D. tessellatus*, F., evidently refers to this species: "an vulpinus. Taken at Oxford in 1821" (*F. W. H.*). The insect will almost certainly be found in houses and stores in the city.]
***Anthrenus varius, F.** In garden, Oxford (*W. H.*).

Family Scarabeidæ.

Aphodius borealis, Gyll. Islip (*W. H.*).
Geotrupes mutator, Marsh. Generally frequent, especially in autumn.

Family Buprestidæ.

[****Aphanisticus emarginatus, F.** It is quite possible that the insect from Bagley Wood, recorded by the late Mr. J. W. Shipp (Entom. Mo. Mag. vol. XXX., p. 15) as *Aphanisticus pusillus*, Ol., may have been the above species, as there are two examples of *A. emarginatus*, evidently mounted by him, in the collection of British Coleoptera in the Oxford University Museum; and another specimen, said to have been taken in Bagley Wood, was submitted by him to Mr. G. C. Champion in 1893 for determination. *A. emarginatus* was introduced as a British species by Mr. Donisthorpe on numerous examples taken in the Isle of Wight (Entom. Record, 1903, p. 265). One example of *A. pusillus* was taken by Mr. Donisthorpe in my company, by sweeping at Wytham Park on September 13th, 1907.]

Family Telephoridæ.

****Dasytes niger, L.** On flowers of *Matricaria* near Radley; one example, July 29th, 1907.

Family Anobiidæ.

Anobium paniceum, L. I found a considerable number of this omnivorous beetle in the stuffing of a dried North African lizard belonging to Mr. G. C. Druce, May 30th, 1907, and have also picked up examples in Summertown.

Family Lamiidæ.

***Agapanthia lineatocollis, Don.** This fine Longicorn occurred rather freely on thistles, *Eupatorium cannabinum, etc.*, at Headington Wick Copse on June 21st and 27th, 1907.

Family Bruchidæ.

***Bruchus loti, Payk.** On *Lotus corniculatus, etc.*; sparingly at Cothill, June, 1907.

Family Chrysomelidæ.

Galerucella calmariensis, L. On rushes in damp places; Tubney, not rare (*J. C.*).

***Longitarsus lycopi, Foudr.** Taken by Mr. Donisthorpe.
***L. reichei, All.** Ogley Bog (*W. H.*).
L. pellucidus, Foudr. Beckley (*W. H.*).
Crepidodera rufipes, L. By sweeping in early summer; Wood Eaton and Kennington, sparingly (*J. C.*).
***Cassida sanguinolenta, F.** By sweeping at Headington Wick Copse; one example, 27th June, 1907.

Family Tenebrionidæ.

Tenebrio obscurus, F. Occasionally in houses, shops, &c., in the city (*A. H. H.*).
Gnathocerus cornutus, F. In fowls' corn, Oxford (*W. H.*).
Tribolium confusum, Duv. Shotover (*W. H.*).

Family Melandryidæ.

***Orchesia micans, Panz.** Bred in numbers from hard fungus on an elm between Islip and Bletchington, June, 1907.

Family Pythidæ.

[****Mycterus curculionoides, F.** A specimen of this curious beetle, doubtfully indigenous to Britain, is recorded by the late Mr. Sidney Olliff, as having been taken by Mr. M. Gunning near Oxford in or about the year 1882. *Cf.* Canon Fowler's "British Coleoptera," vol. IV., p. 57.]

Family Mordellidæ.

***Mordellistena neuwaldeggiana, Panz.** Marston Ferry, beaten from willow, one, 30th June, 1907 (*J. C.*); Roddam Island, R. Cherwell, one on flowers of *Spiræa Ulmaria*, July 1st, 1907.
***M. brevicauda, Boh.** On flowers at Headington Wick Copse; rare, June, 1907.

Family Xylophilidæ.

***Xylophilus populneus, Panz.** By sweeping under elms; Summertown, two examples, June 7th, 1907.

Family Curculionidæ.

***Rhinomacer attelaboides, F.** One example of this usually northern species taken by sweeping under fir trees at Tubney, 11th May, 1907.
***Apion craccæ, L.** Shotover, by sweeping, rare, 22nd September, 1907 (*T. H. Beare*).
A. subulatum, Kirby. By sweeping; Banbury Road near Kidlington, 1st August, 1907 (*J. C.*).
***A. dissimile, Kirby.** On *Trifolium arvense*, L. (Hare's-foot Trefoil) at Tubney; locally common (*W. H.*). Usually a coast species.
****A. annulipes, Wenck.** One example of this rare species taken by Prof. T. Hudson Beare at Shotover, 22nd September, 1907.
***A. atomarium, Kirby.** On *Thymus serpyllum*, near Stanton St. John (*W. H.*).
A. striatum, Kirby. On furze (*Ulex europæus*); Tubney, common (*W. H.*).
A. livescerum, Gyll. Cumnor, June, 1906 (*J. C.*); generally common on the cultivated Sainfoin (*Onobrychis sativa*).
***A. simile, Kirby.** On birch at Hen Wood; sparingly in late autumn, 1906 and 1907 (*W. H.*).

***Polydrusus micans, F.** Wood Eaton; one example by beating, June, 1906 (*J. C.*).

***P. flavipes, De G.** On aspens and poplars, rare; Bagley Wood, 20th May, 1907; Wood Eaton, July, 1907 (*J. C.*).

***Hypera alternans, Steph.** By sweeping near Marston Ferry; one example, 1st July, 1907.

Grypidius equiseti, F. By sweeping at Tubney; one example, 6th October, 1907 (*W. H.*).

****Dorytomus tremulæ, Payk.** Single examples of this rare species have been taken, on white poplar, at Prattwell Wood, near Islip, 23rd June, by Mr. J. Collins, and by myself by sweeping under the same kind of tree at Cothill, 12th October, 1907.

***D. maculatus v. costirostris, Gyll.** On aspens; Bagley Wood, rare, 20th May, 1907.

Bagöus tempestivus, Herbst. In wet places; Yarnton, 24th April, and Kennington, 29th July, 1907.

****Gymnetron linariæ, Panz.** By sweeping in grassy lanes, Cothill and Tubney; rare, May and June, 1907.

****Anthonomus rosinæ, Des Gozis.** By sweeping at Tubney; one example, 1st November, 1907.

Cryptorrhynchus lapathi, L. This conspicuous weevil is recorded in the Minute Book of the Oxford University Entomological Society, 31st May, 1868, by Mr. Pearce, from "a willow bed near the new bathing place," presumably on the Cherwell. I found it in abundance on June 7th, 1907, on osiers at Roddam Island, close to Marston Ferry.

***Ceuthorrhynchus hirtulus, Germ.** By sweeping at Tubney, rare, 6th June, 1907; Chilswell and Stanton St. John (*W. H.*).

****C. pilosellus, Gyll.** A single example of this exceedingly rare species taken in a sand-pit at Tubney, 11th May, 1907.

***Ceuthorrhynchidius quercicola, Payk.** In a tuft at Water Eaton, singly, 21st January, 1907 (*J. C.*).

***C. barnevillei, Grén. (chevrolati, Bris.).** By sweeping *Achillea millefolium* at Cothill; rare, 11th May, 1907.

***Limnobaris pilistriata, Steph.** This insect, now regarded as distinct from *L. t. album*, L., is not rare at Roddam Island and elsewhere on the Cherwell.

***Balaninus turbatus, Gyll.** Marston (*W. H.*).

Magdalis pruni, L. By sweeping and beating in early summer; Bagley Wood, Elsfield, &c.; not rare.

FAMILY **Scolytidæ.**

***Scolytus pruni, Ratz.** Taken freely by Mr. A. H. Hamm in a dead apple tree in his garden, Southfield Road; Wolvercote, numerous dead specimens in an old apple tree, 26th September, 1907.

***S. rugulosus, Ratz.** Tubney, by sweeping, 1st September, 1907 (*J. C.*).

Hylesinus vittatus, F. Bagley (*W. H.*); Tubney, flying, 30th March, 1907 (*A. H. H.*).

***Cissophagus hederæ, Schm.** By sweeping at Elsfield; one, 21st June, 1907.

Pityophthorus pubescens, Marsh. By sweeping under fir trees; Tubney, not rare.

***Xylocleptes bispinus, Dufts.** By beating old stems of *Clematis Vitalba*; Gibraltar Quarries, several, 1st June, 1907.

***Tomicus laricis, F.** Under bark of larch; Boar's Hill (*W. H.*).

ABNORMAL COLEOPTERA.

****Stylops melittæ, Kirby.** The winged ♂ of this extraordinary insect has been taken flying in the University Parks by Mr. A. H. Hamm, who also finds the apterous females not rarely in the bodies of bees of the genus *Andrena.*

****Halictophagus curtisii, Dale.** Also found (females only) by Mr. Hamm, parasitic on bees of the genus *Halictus.*

ADDENDA.

***Sunius diversus, Aubé.** In old manure-heap at Botley; several examples, 12th February, 1908.

***Euthia scydmænoides, Steph.** With the preceding; one example.

***Silpha tristis, Ill.** In moss at Tubney; one, 15th February, 1908.

(As in the "Preliminary List," the names under which the species are here recorded are those used in Messrs. Beare and Donisthorpe's "Catalogue of British Coleoptera," dated 1904.)

The above additions to our Local List are distributed among the primary divisions of the Coleoptera as follows :—

GEODEPHAGA ...	9 species.	MALACODERMATA ...	2 species.
HYDRADEPHAGA ...	3 ,,	LONGICORNIA ...	1 ,,
PHILHYDRIDA ...	4 ,,	PHYTOPHAGA ...	7 ,,
BRACHELYTRA ...	77 ,,	HETEROMERA ...	8 ,,
NECROPHAGA ...	34 ,,	RHYNCHOPHORA ...	33 ,,
LAMELLICORNES ...	2 ,,	ABNORMAL COLEOPTERA	2 ,,
STERNOXI	1 ,,		
		TOTAL	183 species.

Making a grand total of about 1,580 species as yet recorded from our District.

JAMES J. WALKER.

20th February, 1908.

EXTRACTS FROM THE PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY OF LONDON

(April 4th—June 6th, 1906.)

Wednesday, April 4th, 1906.

Mr. A. H. Jones exhibited examples of butterflies taken by him last year in Majorca showing injury to the wings, caused in his opinion by the attacks of lizards. He remarked that a large proportion of the few butterflies met with in the island were mutilated, especially at the posterior part of the hind-wings. A *Gonepteryx cleopatra* and a *Pararge megæra* had semicircular pieces removed, while another specimen of the latter showed that quite half the hind-wings had been removed as though cut by a pair of scissors.

Dr. G. B. Longstaff observed that these butterflies appeared to be much more irregularly treated than the species he had noticed to be similarly attacked in India, and Mr. W. G. Sheldon agreed with the exhibitor as to the cause of the damage, observing that it was unusual where he had collected to find insects attacked in this peculiar way where lizards did not exist.

Wednesday, May 2nd, 1906.

Commander J. J. Walker showed fourteen examples of both sexes of *Hystrichopsylla talpæ*, Curtis, the largest of the British fleas, taken in the nest of a field-mouse in a tuft of grass at Grange, near Gosport, Hants., on March 28th, last.

Dr. F. A. Dixey exhibited male and female specimens of the African Pierines *Belenois thysa*, Hopff., and *Mylothris agathina*, Cram. He drew special attention to the fact that the resemblance between these two species, which Mr. Trimen

speaks of as "deceptively close in both sexes," applies mainly to the dry-season phase of the *Belenois* and not to the wet. This, he observed, was well illustrated by the exhibit, which included wet and dry-season examples of both sexes of *B. thysa*; *M. agathina* showing no seasonal change. The resemblance borne by the male *Belenois* to the male *Mylothris* was much more striking in the dry-season specimen of the former than in the wet; and while the dry-season female *B. hysa* was an excellent copy of the female *M. agathina*, it was seen that the usual wet-season form of the same sex did not mimic the *Mylothris* at all. These facts appeared to be significant in relation to the comparative scarcity of insect food during the dry or winter months, and the consequent greater liability of dry-season forms to the attacks of enemies. The higher need for protection thus experienced by the dry-season forms had been clearly shown by Professor Poulton, who had found in the principle referred to an explanation of the cryptic garb assumed in the dry season by several species of *Precis* (Trans. Ent. Soc. Lond., 1902, pp. 432–443). Other examples of the same phenomenon had been subsequently adduced by the speaker, who had also brought evidence to show that it was especially characteristic of the female sex (Ibid., 1903, pp. 155–158, Pl. vii.). But the present instance differed from all these in the fact that the protection enjoyed by the dry-season phase took the form not of cryptic coloration but of mimicry. The species of *Mylothris* were held on good grounds to be distasteful, and Mr. G. A. K. Marshall had expressed the opinion that *B. thysa* was a Batesian mimic. This might be so, but the speaker rather inclined to the view that the resemblance was synaposematic. In either case the difference between the seasonal phases with respect to their approach to the distasteful model was undoubtedly significant, and he thought it would not be easy to find an explanation better fitting the facts than that just offered.

Mr. H. Eltringham, M.A., F.Z.S., contributed the following paper on "The Late Professor Packard's Paper on the Markings of Organisms." In the absence of the author, Professor E. B. Poulton, F.R.S., explained the drift of the paper, and expressed his agreement with the main lines of argument:—

The late Professor A. T. Packard read a paper before the American Philosophical Society on December 2nd, 1904, in which he criticised at some length the Bates-Müller hypothesis of mimicry. The paper is the more welcome owing to the comparative scarcity of literature dealing with the subject from an antagonistic point of view. Since the promulgation of the presently accepted theories of mimicry and protective resemblance the subject has made very considerable progress. Whilst, however, the strongest supporters of the Bates-Müller theories have lost no opportunity of publishing facts corroborative of the general principles which they uphold, the opponents of these views have for the most part contented themselves with a kind of passive disagreement, usually treating the whole subject with a species of airy contempt, sometimes putting forward somewhat vaguely formulated objections, but in no case, so far as I have been able to ascertain, bringing forward any really satisfactory hypothesis on which to base an explanation of those phenomena for which the Bates-Müller theories seek to account. Nor does the paper in question remove this latter defect. The main conclusion is that the instances of resemblance which have been noted amongst organisms are due, not to any tendency of an unprotected species to resemble for its own benefit, a protected form, but to the biological environment of the species concerned. "Sunlight or excessive contrasts of light and shade combined, moisture and dryness, differences in environment or other climatic causes as affecting the amount and distribution of pigment." It is as a student of the so-called mimicry in butterflies endeavouring to be as impartial as a deep interest in the subject will allow, that I wish to deal with Professor Packard's paper, and the object of the following remarks is to show that the difficulties in the way of accepting that author's arguments against the Bates-Müller theories are at least as great as those which beset their would-be upholders, and that whilst the paper is deserving of the greatest attention as being one of the few lengthy and carefully compiled criticisms of what Dr. Sharp describes as the "fashionable theories," it at the same time falls short of the one essential of providing a really satisfactory alternative.

In his introductory remarks Professor Packard compares the observed cases of mimicry between butterflies with the resemblance of a zebra to an antelope or that of the "spotted leopard of the Old World" to the "jaguar and ocelot of the New World, their habits and environment being the same." But surely the cases are not analogous. No one has ever attributed the resemblance between a leopard and a jaguar to the pattern of either animal being protective by reason of its resemblance to the other. The spotted appearance of a leopard and an ocelot is no doubt a case of what Professor Poulton has described as "syncryptic" coloration, each animal being concealed by resembling the same thing, and such a case is of the same nature as the remarkable resemblance of the under-side of many butterflies to dead leaves. The only difference being that in the case of the butterflies the syncryptic coloration is protective, whereas in the leopard and similar animals it is probably aggressive. Neither form of coloration comes under the head of Batesian or Müllerian resemblance. Following on these remarks, we are told that "what has been understood as protective mimicry, in the sense of Bates and of Müller and their followers, has a precarious basis." But the resemblance of an animal to its inanimate surroundings is not at all "what has been understood as protective mimicry, in the sense of Bates and of Müller and their followers." Professor Packard further maintains that "the Bates-Müller hypotheses are seriously undermined by the fact that the wings of insects were, as early as the Carboniferous period, striped or barred and spotted long before birds ever appeared." I cannot however see that this affects the Bates-Müller hypotheses at all. Such stripes, bars and spots may, for all we know, have been cryptic or epigamic, but this would not preclude the ultimate development either of sematic or pseudosematic coloration.

It will be as well here to recall the fact that Professor Packard entirely misunderstood what is generally known as "Müller's hypothesis." Put very shortly, Müller's suggestion was that butterflies belonging to different genera, both distasteful, might come to resemble one another so that the

general sacrifice to the inexperience of insectivorous enemies would be divided between them.

This theory was published in 1879. Nine years previously Müller had made a tentative suggestion that the resemblance between protected genera had been brought about by sexual selection. It is this theory which Darwin described as "rather too speculative to be introduced into my book," and it is also the theory which Professor Packard regarded as the accepted Mullerian hypothesis. The error has been very fully pointed out by Professor Meldola in a letter to "Nature" published in November 1905, and materially affects the value of Professor Packard's criticisms.

Mr. Abbot H. Thayer's view that the colours of animals are such as to cause the creature to cease to appear at all, appears to be merely a universal application of the theory of cryptic coloration. Instances of cryptic coloration are too common to admit of any doubt whatever, but to maintain that every animal is coloured for concealment appears to me to be too much of a generalization. Probably few would deny that warning colours are exhibited by many stinging insects, distasteful caterpillars and other offensive creatures, to take only the insects alone. Mammals and reptiles, however, are also known to exhibit warning colours, as for instance the skunk with its white tail, the coral snake, and certain brightly coloured frogs described in Mr. Belt's "Naturalist in Nicaragua." The warning colours exhibited by certain caterpillars have formed the subject of much experiment by well-known investigators, and all are agreed that insect-eating animals refuse those larvæ which possess conspicuous coloration.

Professor Packard next proceeds to emphasize the paucity of evidence on which rests the theory that insectivorous birds are the principal agents of natural selection in Lepidoptera. Here I feel myself bound to agree that the recorded instances of butterflies forming the staple food of birds are few and far between. It would at first sight appear that if birds are really the principal cause of modification in the markings of butterflies' wings there ought to be no necessity for the supporters of the Bates-Müller theories to be obliged to seek out instances of birds eating butterflies. It should be generally recognized

that birds do actually destroy butterflies in large numbers, but on the other hand most experienced collectors seem agreed that the sight of a bird even chasing a butterfly is of rare occurrence. One point, however, is frequently overlooked alike by the supporters and opponents of the Bates-Müller theories, viz.—that it is not to be expected that any of the full-grown and experienced birds will be frequently observed catching butterflies, since they have already learned to avoid the distasteful species and incidentally their imitators. Only the young birds will attack and experiment with distasteful and edible kinds alike, and since on the one hand, young birds are notably retiring and inconspicuous and furthermore will speedily learn that butterflies are unprofitable prey, it is not to be wondered at that birds are not universally observed to be butterfly eaters.

Many common occurrences in nature are exceedingly difficult to observe, and it would seem at least possible that the destruction of butterflies by young birds is carried on to a far greater extent than would appear from casual observation. The evidence adduced by Professor Packard is to some extent contradictory, and whilst some of the observers assert that they have never seen butterflies attacked by birds, others again mention numerous cases of this form of destruction. Instances are given of butterflies being eaten by birds in North America, India, Ceylon, Burmah, Natal, etc., but it must be acknowledged that the evidence on this head, and upon which undoubtedly rest, to a great extent, the Bates-Müller theories, is by no means so complete as is desirable for their thorough establishment.

Professor Packard then proceeds to discuss the case of *Anosia plexippus*, which is usually considered to be a distasteful species mimicked by *Limenitis disippus*. Evidence of the edibility or otherwise of *Limenitis* is wanting, but judging by the abundance of individuals and slow flight, it may be regarded as a protected genus. As regards *Anosia plexippus*, the evidence adduced certainly goes to show that the insect is distasteful, since in one case the insect was caught but not eaten, and in the second was refused with apparent signs of disgust after close inspection. The statement further adduced

that *Limenitis disippus* has never been seen to be attacked, goes to confirm the conclusion that it is also inedible.

Professor Packard then proceeds to give the observations of Mr. Finn given in his "Contributions to the Theory of Warning Colours and Mimicry." Little need be said here on the subject of these experiments, except to quote Mr. Finn's final conclusions: "That many, probably most, species (of birds) dislike, if not intensely, at any rate in comparison with other butterflies, the 'warningly coloured' *Danainæ, Acræa violæ, Delias eucharis* and *Papilio aristolochiæ;* of these the last being the most distasteful, and the *Danainæ* the least so."

In the paper under discussion considerable space is devoted to enumerating instances of birds eating butterflies both under natural conditions and in captivity, and the general impression to be gained from the expressed opinions of the various authorities quoted may be summed up in the statement that whilst some birds in the wild state, and many in captivity, show a marked appetite for butterflies, observations of instances of the destruction of the latter by the former are of rare occurrence.

It should not be however forgotten that where evidence of such destruction has been systematically sought it has been found to be plentiful, and I would refer those interested to the very extensive work in this direction which has been carried out by Mr. G. A. K. Marshall in South Africa, a full description of which has been given in the joint communication of that author and Professor Poulton, and published in the Transactions of this Society for 1902.

There is, however, one aspect of the matter which the writer does not remember to have been previously put forward, and that is the possible value of the force of example amongst birds. It is well known that young birds are to some extent trained by the example of their parents in many matters which make for their ultimate success in the battle for existence. They may and probably do indulge in much experimental tasting, but the extent of such action may to a great extent be curtailed by the example of the parents in selecting more satisfactory food than butterflies *in their present condition* afford. Such a state of affairs would

minimize the present, or in some cases the *local* destruction of butterflies by birds, and consequently also the number of observed cases of such destruction, but it would not preclude the possibility that a much more extensive process of selection took place amongst butterflies in earlier times. In other words the balance of nature is now maintained by other and various agencies acting in concert with the now much-reduced influence of insectivorous birds, and we are present now only to see a state of affairs brought about by agencies which have become considerably modified in their *relative* influences.

It will probably be immediately pointed out that if the selective influence of birds is not as great as ever it was the well-known tendency of reversion to ancestral forms would tend to do away with mimicry, and that only by constant pressure of selective forces can mimetic resemblance be maintained. But is there any evidence that mimicry amongst butterflies is at present more extensive and complete than it has ever been before? Have we any right to say that all cases of imperfect mimicry are in process of being perfected and not undergoing reversion? I have never been satisfied that the white-winged form of *Hypolimnas misippus* is really a mimic of the *alcippus* variety of *Danais chrysippus*, extremely attractive as the suggestion undoubtedly is. One cannot forget that the male *misippus* has large white patches, and the lack of geographical coincidence between *alcippus* and *misippus* is much against the mimetic theory. The *alcippus* form may be also a reversion, or it may be, as suggested by Professor Poulton, an effort towards more conspicuous coloration. If such be the case, we have here an instance of accidental resemblance, a phenomenon which I cannot but believe does occasionally occur. Such a suggestion will probably be looked upon with disfavour by keen supporters of Bates's hypothesis, but I do not see that that hypothesis loses anything by the admission that every case of resemblance is not necessarily true mimicry. Many other cases of imperfect resemblance might be cited which can just as easily be regarded as instances of partial reversion as of incomplete development. I do not necessarily insist on the theory that birds have partially ceased to be a selective force acting on

butterflies, but I do suggest that even if it be proved that they are not so now, it by no means follows that they never were.

It may be further objected that if the selective force of birds is no longer as strong as it was, what influence maintains those accurate cases of mimicry with which we are all familiar? To this one may reply that we are ignorant of the *relative* power of the forces which guide development. So long as existence depended upon favourable variation, sexual selection may have been too weak to prevent such variation. Sexual selection may, however, be sufficient in some species to maintain facies which have been perfected through long periods of evolution. Such suggestions are merely speculative, but they may serve to remind those who would lay down laws for mimetic development, how complicated both in their nature and in their effect, are the influences which guide the course of evolution.

In discussing the Batesian and Müllerian theories, Prof. Packard's paper lays much stress on the explanation that resemblance between butterflies is due to convergence brought about by similarity in their surroundings. Thus we read—"From the facts regarding these local varieties thus stated by Bates, we seem warranted in ascribing the mimetic resemblance to convergence, or exposure to the same conditions of light, heat, moisture, etc., affecting all the individuals of a variety simultaneously rather than to what is vaguely called natural selection." And again—"The colour and markings of animals in general are primarily due to the action of light and the colour of the environment or background. To suppose that in the case of butterflies alone the colours of the mimics are due to the attacks of birds, whereas remarkably few butterflies, as we have seen, are ever eaten by them, is a cause so inadequate, so limited in its scope and so one-sided, that it is no wonder the hypothesis has so many opponents." In these observations, we seem again to have the idea of climatic influence, and it appears to me to be desirable here to quote the words of Professor Poulton in his paper read before the Linnean Society in March 1898—"There is something attractive and plausible in the suggestion that the

strong mutual resemblance within a group of butterflies of different genera and sub-families, inhabiting a single locality, are due to the direct action of peculiar local physical or chemical influences; but the suggestion loses all its attractiveness when it is applied to the resemblance between a spider and an ant or a moth and a wasp, and yet few could bring themselves to believe that the resemblances which are here contrasted have been built up by two entirely different sets of forces." In another part of the same paper, Professor Poulton points out the very different conditions under which the larval stages of mimetic insects undergo their development. Thus the larva of the drone fly lives on putrefying animal matter, "a food as different as possible from that provided for the larval bee," and we are reminded that "when the imago emerges from the pupa and its expanded wings have dried, nothing that it will eat or endure henceforward produces any further effect upon its colours or patterns. Hence identity of food and condition during the final stage cannot be of any assistance to the interpretation of mimicry."

Professor Packard further proceeds to point out that bright colours are not invariably associated with a nauseous taste or smell, but surely a negative fact of this kind does not in any way invalidate the theory of warning colours. The fact that certain nauseous insects have not developed warning colours does not appear to show that the bright colours of other nauseous insects are not of a warning nature, neither does the fact that certain inedible moths have no mimics materially affect the question.

There is fairly conclusive evidence that inedible species of butterflies adopt for the most part a slow, negligent form of flight. This habit, which has probably arisen through immunity from pursuit, also serves to display those colours which are supposed to be of a warning nature. It is a remarkable fact that mimetic species, though belonging to genera which ordinarily fly quickly, also exhibit the same carelessness of pursuit. This latter fact is referred to in Professor Packard's paper, and it is even suggested that climatic or local causes may be sufficient to account for a change in the mode of flight. I cannot but think that such a

suggestion is carrying the climatic theory to a somewhat unwarrantable length. We are next reminded of Eisig's suggestion that "those bright colours of animals which have hitherto been regarded as of warning significance, are merely the substance or secretions which confer the unpleasant taste, and that therefore Wallace's older interpretation is unnecessary and, in fact, erroneous." Now we have already been told that the existence of very inconspicuous animals of a highly distasteful nature is an argument against the theory of warning colours, and yet in the next breath a theory is quoted which to be adequately supported would require that these highly distasteful insects should also be highly coloured.

At the end of the next section the author discusses the case of the brightly coloured Nicaraguan frog which I mentioned in the earlier portion of my remarks. Whilst allowing that the frog is inedible and that its gay colours have taught the birds to avoid it, it is maintained that the cause of the bright colours has been exposure to the bright sunlight and consequent excessive pigmentation. On this supposition the bright colours would have been developed just the same had the creature been of an edible species, except that such colours would have soon resulted in the animal's entire extinction. It is therefore merely accident that the bright colours and inedible qualities co-exist. I am prepared to submit that in one or two isolated cases such an accident might be possible; for the sake of argument I would even go so far as to allow that in the case of the frog, the co-existence of bright colours and inedibility is accidental, or the result of climatic conditions, or even that the inedible qualities are the *sources* of the bright colouring. Then for the sake of further argument let us suppose that all such cases have arisen from one of these causes, and we are faced with the difficulty that *Papilio merope*, for instance, can produce from one batch of eggs the typical male, and the *trophonius*, *cenea*, and the black and white forms of female, all entirely different in appearance, the females not resembling the males in the least, and each closely resembling a common inedible Danaid, all of which surprising and varied results are achieved by either accident, similar climatic conditions, or distasteful pigments of the existence of which there is no evidence. I

must confess that I find it harder to believe all this than that birds either do or once did exercise a powerful selective influence over butterflies. The question of snakes is next considered. In Brazil, we are told that eight species of harmless snakes mimic the same number of species of *Elaps*. Then, as if to counterbalance this unfortunate evidence, it is pointed out that three harmless genera mimic the poisonous genera *and the latter prey on the former*, so that they are not protected except from birds. But surely whilst being protected from birds and mammals, they are protected from their poisonous enemies by their resemblance to them, unless the poisonous ones prey on each other. The case is a complicated one, and appears to exhibit protective and aggressive resemblance respectively in the two genera, but brought about by the same means. The balance of nature has been reduced to a fine point.

In the next section the author cites a case in which a brown *Euplœa*, a *Danais*, and a *Hypolimnas*, all much alike, are observed to fly together. Mr. G. F. Mathew maintains that all these three genera are avoided by birds, and the case is given as one to which the Müllerian theory is therefore inapplicable. I cannot help thinking, however, that the case is one to which the Müllerian theory precisely applies, and the paragraph only goes to confirm Professor Meldola's contention that Professor Packard did not understand the Müllerian hypothesis at all.

The remainder of the paper is devoted to an able and interesting discussion on the origin of the markings of mammals, the effect of the blending of colours when the animals are in motion, and other matters. Deeply interesting as this portion is, it hardly bears on the case of butterfly mimicry. Animals which develop their external attributes of colour and markings under the life-long influence of light and shade, colours which are for the most part cryptic, though presumably developed by natural selection, cannot be compared to creatures which reach full colour and pattern development in an hour or so after emerging from the pupa, and which moreover can produce such diverse forms, as for instance the male and female *Hypolimnas misippus*, from the same batch of larvæ fed and pupated under the same physical conditions.

In conclusion, I trust it will not appear to be an act of presumption on my part to attempt to criticise the work of the eminent naturalist whose loss we must all deplore. I am well aware that an amateur naturalist like myself has not the opportunity of making the extensive and careful researches which have made the writings of our prominent scientists such magnificent records of devotion to their work.

The remarks I have here ventured to make are merely the expression of the thoughts which have occurred to me in a humble endeavour to arrive at sound conclusions on a most complicated, difficult, and deeply interesting subject.

For some years I have been making a special study of the most interesting forms of mimetic resemblance, more particularly amongst the African Rhopalocera, and I have invariably been much touched by the ready assistance which has been afforded me even by those prominent workers with whom I am acquainted only by correspondence, and it will always be my desire to reciprocate in every way which lies in my power. It is therefore with these thoughts in my mind that I should wish my remarks on Professor Packard's paper to be regarded in the light of a friendly discussion on a subject of mutual interest, and not in any way a criticism of the personal views of a naturalist whose work must ever command the respect, both of those whose attainments entitle them to rank with him in eminence, and also of those who, like myself, are of the humbler, though I trust not less faithful workers.

Finally, I would gratefully acknowledge the help I have received from Professor Poulton, who has very kindly furnished me with references and data which have been of great assistance in the preparation of the foregoing remarks.

Wednesday, June 6th, 1906.

Dr. F. A. Dixey exhibited specimens of eight species of Pierine butterflies, and remarked on them as follows :—

"It is well known that many kinds of butterflies, especially Pierines, are in the habit of congregating in large numbers on

damp patches of soil for the sake of absorbing the moisture. This phenomenon occurs to some extent in temperate regions, but it is in tropical and sub-tropical districts of both the old and the new world that the size and frequency of such assemblages have attracted most attention. Mr. Distant ('Rhopalocera Malayana,' 1882–1886, pp. 284, 285) has brought together several instances from the experience of various travellers, and many others are on record. By the kindness of Professor Poulton I am able to show representative examples of 153 specimens captured under these conditions by Mr. C. A. Wiggins, a well-known official of the British East African Protectorate, to whom Science is indebted for the fine collection of Rhopalocera from Uganda lately described by Mr. Neave ('Novitat. Zoolog.,' vol. XI, 1904). Mr. Wiggins's note to the series represented by the exhibit is as follows :—

"'All these (over 150) were caught in one sweep of the net over a pool within a few yards of the Ripon Falls, Jinja, Lake Victoria Nyanza, by C. A. Wiggins, on Feb. 2, 1906.'

"The catch consists entirely of Pierines of the two genera *Pinacopteryx* and *Belenois*. Eight species are represented, the numbers being as follows :—

Pinacopteryx vidua, Butl.	104
,, *pigea*, Boisd. (northern form)	17
,, *liliana*, Grose Smith	5
Belenois solilucis, Butl.	1
,, *subeida*, Feld. (form *instabilis* Butl.)	8
,, *formosa*, Butl.	12
,, *gidica*, Godt.	1
,, *severina*, Cram. (form *boguensis*, Feld.)	5
Total	153

"Every one of the 153 specimens is a male. The *B. gidica* is of the 'wet-season' form, the others are all more or less 'dry.' The great preponderance of *P. vidua* is noticeable, as is also the generally good condition of most of the specimens making up the somewhat significant figure of the total."

In answer to questions, Dr. Dixey said that he had no further information from Mr. Wiggins than that which he had already given. He should be disposed to infer from the words, "caught in one sweep of the net over a pool," that

the butterflies were disturbed while drinking, and the net dashed among them just as they were taking wing.*

Professor E. B. Poulton, F.R.S., communicated some notes on Natal butterflies which he had received from Mr. Geo. H. Burn, of Weenen. This naturalist, writing January 19, 1905, stated that he had that week returned from a trip down the Tugela Valley, during which he had spent about ten days in the valley of its tributary, the Umhlangane River, about thirty-five miles from Weenen. "While there," he wrote, "I obtained many good specimens, amongst others, *Iolaus pallene, aphnæoides, bowkeri* and *sidus; Aphnæus* [*Spindasis*] *masilikazi, ella, phanes* and [*Choroselas*] *pseudozeritis; Cœnyra hebe* and *Axiocerces amanga*. I was particularly pleased to get *aphnæoides*, which is very rare. About ten years ago I captured a few about thirty miles higher up the Tugela. This is the first time I have seen *C. hebe* in life. I fancy it must be very local. All the species I have mentioned, and many other butterflies, were taken off the flowers of the Umchechau tree or shrub, growing along the banks of the spruit. These flowers seem to attract insects of all descriptions, as well as butterflies and moths. Among Coleoptera, the *Lycidæ* were very numerous on it. The flowers of the Umandane tree similarly attract all sorts of insects in this neighbourhood during September and October. *Aphnæoides* would seem to differ from others of its group, inasmuch as it appears always to settle on a flower in the middle and most inaccessible part of the bush, whereas *pallene* and other species apparently prefer the outer branches.

"I am inclined to think, from a good many years of observation, that the anal appendages (at any rate in the case of the *Iolaus* and *Aphnæus* groups) of many butterflies are intended to deceive their enemies by resembling antennæ. I have repeatedly come across fresh specimens with that part of the

* The following passages show the possibility of such an explanation :— "Large numbers of white butterflies may be seen quenching their thirst on the damp ground, and flying up when disturbed, in quite a startling cloud" (MS. note by Dr. Thwaites in Moore's "Lepidoptera of Ceylon," vol. I, 1880–81, p. 117). Mr. E. L. Arnold (quoted in Distant, *loc. cit.*) describes a "countless host of thirsty butterflies, collected from the forest all round to drink . . . . crowded so close by the water that the sand could scarcely be seen," and when disturbed, "springing into the air in a huge cloud." [F. A. D.]

hind-wings injured, in many cases apparently bitten completely out, and I incline to the belief that *Mantidæ* are the chief enemies of butterflies in the imago stage. A few days ago I noticed a very large green *Mantis* 'stalking' an *I. pallene.* The *Mantis* apparently was trying to edge round to the part where the tails were. I watched it for some time, when unfortunately a wasp settled on the flower and frightened the *pallene* away."

Professor POULTON observed that it was extremely interesting thus to gain further independent evidence in favour of the interpretation of the "tails" of *Lycænidæ* as antenna-like directive structures adapted to divert the attacks of an enemy from a vital to a non-vital part of their prey. It is difficult to resist the conclusion that this interpretation is correct when it has been independently reached by so many naturalists :—Dr. Arnold and Dr. Forsström (quoted by Kirby and Spence in 1817 as Dr. G. B. Longstaff has recently pointed out*), Dr. R. C. L. Perkins, Dr. Richard Evans, Mr. Champion B. Russell, Mr. E. A. Floyer, Dr. Longstaff, and lastly by the excellent observer who is quoted on the present occasion. (See Trans. Ent. Soc., Lond., 1902, pp. 373, 374; 1906, pp. 106, 107.)

Professor E. B. POULTON also exhibited the four individuals of *Euralia mima*, Trim., and the four of *E. wahlbergi*, Wallgr., captured by Mr. G. A. K. Marshall on the Umbilo River, near Malvern, Natal, on June 28, 1897, as described in Trans. Ent. Soc. Lond., 1902, pp. 491, 492. He showed their respective Danaine models *Amauris echeria*, Boisd., and *A. niavius*, L., form *dominicanus*, Trim., and explained the reasons why Mr. Marshall considered the mimics to be two forms of a single species (*l.c.* p. 491). Professor Poulton had written to Mr. G. F. Leigh, advising him to make the attempt to breed from one form or the other, and thus settle the question. Mr. Leigh had done his best but failed in this attempt. He had how-

* Dr. Longstaff's recent note (Trans. Ent. Soc. Lond., 1906, pp. 106, 107) referring to my discussion of the tails of *Lycænids* (*l. c.*, 1902, p. 374), supplies a good example of the liability to error in quoting an unusual name. In my account the name Forsström is rendered Forsströna, in Dr. Longstaff's Forström. The generic name *Hesperia*, which at first puzzled Dr. Longstaff in the first edition of Kirby and Spence (1817), is replaced by *Thecla* in the fifth (1828, vol. ii, p. 251). *Hesperia* persists in the third edition (1823, vol. ii, p. 254). I have not seen the fourth. [E.B.P.]

ever made special observations on the two forms which are an interesting addition to our knowledge of them. The differences revealed in the course of this inquiry had convinced Mr. Leigh that the two forms are entirely distinct species. Professor Poulton was by no means convinced of the soundness of this conclusion. The extraordinary facts now recognized in the genus *Precis* show us that differences of instinctive behaviour are not necessarily evidence of specific distinction. Indeed every difference relied upon by Mr. Leigh breaks down when tried by the test of this searching comparison. Professor Poulton much hoped that the food-plant would be discovered, eggs obtained, and the only convincing evidence made available. The following paper shows that Mr. Leigh is intimately acquainted with these forms in Natal, and the Society may anticipate that his energy and powers of observation will ultimately lead to success in the decision of this difficult and interesting question.

NOTES ON *Euralia wahlbergi*, WALLGR., AND *E. mima*, TRIM., BY G. F. LEIGH, F.E.S.

Having read (Trans. Ent. Soc. Lond. 1902, pp. 491, 492) that these two butterflies are thought to form but a single species, I have during this season (1904–5) been closely observing their habits. I now offer full particulars of what I have seen,—particulars which in my opinion support the conclusion that the two forms are entirely distinct species.

It has been inferred that they are probably the same species because "they have been taken *in coitu* several times" (*l.c.*, p. 491). This I do not regard as very strong evidence; for I have taken *Eronia cleodora* and *E. leda*, *in coitu*, also *Neptis agatha* and *Eurytela hiarbas*. The only intermediate specimen I know of here may well be a hybrid result of such pairing; for the characters of both *mima* and *wahlbergi* are represented upon it. The other reason given is "that the two forms are always found together wherever they are met with in any number" (*l.c.*, p. 491). This may be a fact, but it is also true that they fly just as often with *Planema esebria*, *Planema aganice*, *Amauris echeria*, and *Papilio brasidas*, *E. mima* very much resembling the latter when on the wing. I give below a

summary of the habits of these two forms so far as I have observed them in Natal. It will be seen at a glance that they are widely different.

E. wahlbergi.	*E. mima.*
To be found from middle of December and during January and part of February.*	To be found about first week in January and during February.
Imago emerges from pupa between 9.30 and 11.30 a.m.	Emerges between 2 and 4 p.m., never in the morning.
Always rests upon upper surface of leaves or the ground with wings folded except when drying after emergence, when they are continually opened and shut like those of a Saturnid moth.	Always rests upon the underside of the leaf with wings shut and hanging down, except when drying, which usually occurs upon the sand or very low herbage.
Flight slow and hovering, and when disturbed the insect usually returns after a time to the same spot, often to the same leaf.	Flight very much quicker than *E. wahlbergi*, and if disturbed or missed the butterfly flies high and does not return to the same place.
Very much commoner than *E. mima*: at least ten of *wahlbergi* may be seen to one of *mima*.	One of the rare species here. I should consider ten to twelve a probable estimate of the number which might be seen in an average season.

I think there is sufficient difference in the habits set forth above to indicate that we are dealing with distinct species, but a few additional remarks may not be out of place. I have often seen and captured specimens of *wahlbergi* no larger than *E. mima*, but I have never seen, or heard of any of the latter that in any way approach the size of a very large proportion of the former. *Wahlbergi* may also be seen in gardens and sometimes even in the public roads, while *mima* is very rarely found except in shady glades in the bush.

* Mr. Leigh writes on May 26, 1906:—"I have seen two or three *Euralia wahlbergi* this month: last year I saw none after February and early March. The specimens now seen are very much larger than the earlier brood, but not so common." [E. B. P.]

The following is a precise record of the examples of both species I have seen, captured, or heard of during December 1904 and January 1905, in Stella Bush, Durban.

1904.
December 16 Morning: captured 1 *E. wahlbergi.*
,, 17 ,, ,, 1 and saw 2 ditto.
,, 18 ,, ,, pair *wahlbergi* in cop.*
,, 19 ,, ,, 2. Afternoon saw one.
,, 20 ,, ,, 1. Heard of 3 specimens being captured in garden in Musgrave Road, Durban.
,, 21 Saw 3 specimens in morning.
,, 22 Captured 2 specimens in morning just emerged.
,, 23 ,, 1 specimen in afternoon, damaged.
,, 24, 25, 26, 27. Not in Durban.
,, 28 Saw 3 specimens in morning.
,, 29 Morning: captured 2 specimens, 1 perfect and 1 ♀ with three wings.†
,, 30 Saw 2 specimens in morning, 1 in afternoon.
,, 31 January 1 and 2. Not in Durban.

1905
January 3 Captured 1 in morning and 1 in afternoon, saw 2 others.
,, 4 ,, 2 ,, (raining in afternoon).
,, 5 ,, 3 ,, and 2 in afternoon.
,, 6 ,, 1 ,, saw 4 others, 2 damaged.
,, 7 and 8. Not in Durban,
,, 9 Captured 3 in morning, saw 1 *mima* in afternoon.
,, 10 ,, 5 *wahlbergi* in morning, saw 2 in afternoon.
,, 11 ,, 2 ,, ,, ,, 3 others, captured 2 freshly emerged *mima* in afternoon.
,, 12 Captured 6 *wahlbergi* in morning and 2 in afternoon: also captured 1 *mima* and saw 2 others, all 3 freshly emerged, and going to rest early, as a bad storm commenced about 4 p.m.
,, 13 Captured 2 *wahlbergi* in morning, saw 2 others, heard of 1 *mima* being captured on the Bluff, Durban.
,, 14 and 15. Not in Durban.
,, 16 Captured 1 *wahlbergi* and 1 *mima*, and saw another of the latter, all in the afternoon.
,, 17 Captured 3 *wahlbergi* in morning and 2 in the afternoon, and 1 *mima* going to rest as late as 5.30.
,, 18 Not out in morning, captured 1 *mima* in afternoon.

* The ♀ was kept alive for over a week, but no ova were laid.
† Kept alive for three days, but no ova laid.

1905.

January 19 Morning: captured 10 *wahlbergi* and saw 3 others, 1 badly crippled. Afternoon: saw 2 more *wahlbergi*, no *mima*, but had 2 perfect specimens of latter given me, captured about 3 p.m. in another part of Stella Bush. They had only just emerged, and the wings were hardly dry.

,, 20 Captured 3 *wahlbergi* and saw 1 *mima* in morning.

,, 21 and 22. Not in Durban.

,, 23 Captured 2 *wahlbergi* in morning and 2 in afternoon; saw 4 others, including a pair *in coitu*; captured 1 *mima* just out and saw another in afternoon.

,, 24 Captured 5 *wahlbergi* and saw 4 others in morning, raining all afternoon.

,, 25 Captured 2 *wahlbergi* and saw 1 other in morning; saw 1 *mima* in afternoon. A dull damp day.

,, 26 Captured 1 *wahlbergi* * and saw another in morning; captured 1 freshly emerged *mima* in afternoon. Raining nearly all day.

,, 27 Afternoon: captured 3 *wahlbergi* and saw 1 other; saw 2 *mima in coitu*. Wet, dull morning.

At this point the observations ceased, as I was unable to continue my regular visits to the locality in which the above recorded notes were made.

To sum up:—Between December 16, 1904, and January 27, 1905, I captured, saw, or heard of being captured just 121 *E. wahlbergi*, and between January 9 and 27, 1905, I captured, saw, or heard of being captured just 20 *mima*.

These numbers, especially of *mima*, are greatly in excess of anything that I have before observed in this locality. The *mima* captured in the season 1904–5 indeed exceed the total that I have been able to obtain in the five previous seasons together, that is during the whole of my experience of this locality. This remarkable abundance I attribute to the fact that the glade had only been made about three and a half months, and was therefore practically virgin ground.

Although I saw *wahlbergi in coitu* on several occasions and *mima* once, I never saw the two forms pairing together, and not very frequently flying together, except on the afternoon of January 12, when there was a very bad storm with

* A crippled ♀ kept alive for ova without success.

hail, and all species of butterflies were going to rest unusually early. It is very unfortunate I have not been successful in getting any ova from the ♀s kept for this purpose, but even had I done so, I am not at all sure that I know the food plant. Roland Trimen, F.R.S., in his work suggests a tree, but I think that the Buck Weed is far more probable, as nearly all the recorded specimens were settling on or flying over this plant. I several times searched unsuccessfully for the pupa-cases, although a great many of the *wahlbergi* had scarcely dried their wings when captured, and in several cases I observed on the leaves beneath the spot where a butterfly had been resting the excretory fluid which is ejected shortly after emergence.

Professor POULTON also exhibited Mr. Guy A. K. Marshall's latest demonstration of seasonal phases in South African species of the genus *Precis*—the proof, by actual breeding, that *P. tukuoa*, Wallgr., is the dry season phase of *P. ceryne*, Boisd.

The female parent of the wet phase was captured April 2, 1905, at Salisbury, Mashonaland (5000 ft.). The eggs were laid on the following day, and all hatched April 13. The eight offspring were treated, and went through their transformations as follows:—

		1905.		1905.			
1.	Pupated	May 9.	Emerged	May 27,	as a dry	phase	♀
2.	,,	,, 12.	,,	,, 31,	,,	,,	♂
3.	,,	,, 12.	,,	,, 31,	,,	,,	♀
4.	,,	,, 12.	,,	June 1,	,,	,,	♀
5.	,,	,, 13.	,,	,, 1,	,,	,,	♂
6.	,,	,, 15.	,,	,, 2,	,,	,,	♂

7. Pupated and subjected to damp heat, May 15, 1905. Emerged May 23, 1905, as a dry phase ♂
8. Pupated and subjected to damp heat, May 15, 1905. Emerged May 23, 1905, as a dry phase ♂

The whole of the offspring are marked examples of the *tukuoa* or dry phase. The damp heat to which Nos. 7 and 8 were subjected hurried the transformation in a remarkable manner, the pupal period only enduring for eight days, instead of from eighteen to twenty days, as in Nos. 1–6. But with

all this hardly any effect, if any, has been wrought upon the pigments. The upper-side colouring of Nos. 7 and 8 is very slightly lighter than that of two out of the three other males (Nos. 2, 5, and 6), but is about the same as the third. Upon the under-side, where the essential distinction between the phases is manifest, no difference can be detected.

Professor E. B. POULTON exhibited ten specimens of *Precis sesamus*, captured at a height of about 5000 ft. on the S.E. slopes of Kilimanjaro by the Rev. K. St. Aubyn Rogers. The dates, seasonal phases and condition of the specimens are shown below :

Mamba state,
1905.

Sept. 19, 1 *Precis sesamus*, ⊙ (dry season phase), not much worn.
,, 22, 1 ,, ,, ⊙ ,, ,, nearly perfect.
,, 22, 1 ,, ,, ⊙ ,, ,, rather worn.
,, 22, 1 ,, ,, ⊙ slight tendency towards intermediate ; worn.
,, 22, 1 ,, ,, ⊙ very much worn and very ragged. The symmetrical injuries suggest the attack of a bird or lizard.
,, 22, *in coitû* { 1 ♂ *Precis sesamus*, ⊕ (wet season phase), quite fresh.
1 ♀ ,, ,, ⊙ slight tendency towards intermediate. Slightly worn and very badly notched and torn, probably by enemies.
,, 25, 1 *Precis sesamus*, ⊙ worn and much notched.
,, 25, 1 ,, ,, ⊖ (intermediate.) On dry side of intermediate. Much worn and a great part of both hind-wings shorn away.

Marang state,
1905.

Sept. 25, 1 ,, ,, ⊙ very slight tendency towards intermediate. Worn and notched.

Concerning these specimens Mr. St. Aubyn Rogers wrote on September 29, 1905 :—

" I was very interested to meet with *Precis sesamus* for the first time. All the specimens except one were of the winter

form, and were more or less worn. The one exception was a beautiful fresh *natalensis* which was taken *in coitu* with *sesamus*. One *sesamus* has the red spots considerably elongated, thus showing some approach to *natalensis*.

"During the whole time I was on the mountain the weather was for the most part cloudy and showery, so that I was unable to go up to the higher levels as I had hoped. I did go as far as the forest which extends upwards for about 6000 ft., but everything was dripping, though it was one of the finest days we had, and no butterflies came within reach, in fact only two or three were seen. In the forest there are ferns and mosses everywhere carpeting the ground and hanging in festoons from every branch, and the begonias form great bushes 20 ft. high."

Still more recently the following interesting notes on the subject have been received from the same keen and observant naturalist:—

"I saw one other *natalensis* which was also quite fresh, so it is fairly certain that I was on Kilimanjaro just at the time when the wet-season phase was appearing.

"I fear I have no first-hand knowledge of the seasons on Kilimanjaro except what I can assume from living well within sight of it, and being able to tell from the amount of cloud what the weather is like. (We are not more than ten or twelve miles from the mountain, which rises from the plain on which we live, and probably not more than five or six from the nearest foot-hills.) I have, however, inquired diligently, and I am informed that the wet season lasts with short breaks from the middle of March till the end of November, so that I was there towards the end of the *wet season*, when one would expect the *dry phase* to be beginning to show up, and the *wet phase* to be still predominant though somewhat worn, whereas the facts were exactly opposite to this. Possibly the explanation is that during the wet season, or at any rate a good part of it, the clouds hang so heavily over the mountain, even at 5000 ft., that butterfly life is reduced to a minimum from want of sunshine, not from want of moisture, and I am told that during this season for weeks at a time the sun is scarcely seen at all. The period of the year when butterflies

are most abundant is during the dry season, if it may be so called where the country never dries up at all. During the wet season it is so wet and cold that very few insects are on the wing, but during the months of December—February there is plenty of sunshine and quite sufficient moisture for all needs of insects. It is curious that the seasons at which the wet and dry phases are found do not vary much from those further south, where the seasons are so very different."

Professor Poulton observed that the facts were extremely remarkable, and must be taken into account in the attempt to interpret the nature of the change from the one form into the other. By themselves they seemed to suggest temperature and not degree of moisture as the controlling factor. The facts were, however, equally in accordance with the hypothesis that the changes are due to internal causes and merely more or less parallel with the seasons without being caused by them, so that local reversal of the wet or dry periods is unaccompanied by a corresponding reversal in the phases of the insect. But the problem is too difficult and complex to be solved by these observations alone, interesting and suggestive as they are.

Professor Poulton exhibited 325 butterflies captured on one day by Mr. C. B. Roberts, between the eighth and tenth mile from the Potaro River on the road to the gold-mines. The road starts from the Potaro 30 miles above its confluence with the Essequibo. The capture was effected February 23, 1904, and may be compared with that of August 28, 1903, exhibited to the Society on November 4 of the same year. The following statement sets forth the constitution of the two sets of butterflies :—

		Aug. 28, 1903. Mid short dry season.	Feb. 23, 1904. Mid long dry season.
1st Ithomiine-centred (*M. mneme*) Group.	*Melinæa mneme* . .	250 ♂ *3 ?	220 ♂
	,, *crameri* . .	8 ♂	7 ♂
	,, *egina* . . .	9 ♂	21 ♂
	Mechanitis pannifera .	10 ♂	4 ♂
	,, *polymnia* . .	9 ♂	3 ♂
	Lycorea ceres . . .	1 ♂	0
	,, *pasinuntia* . .	3 ♂	7 ♂
	Heliconius vetustus . .	1	0
	Eueides nigrofulva . .	1	0
2nd Ithomiine-centred (*C. vallonia*) Group.	*Ceratinia vallonia* . .	15 ♂ 1 ♀	58 ♂
	Napeogenes pheranthes .	1 ♂	0
	Ceratinia barii . . .	4 ♂	0
3rd Ithomiine-centred (*I. zarepha*) Group.	*Ithomia zarepha* . .	1 ♂	0
4th Ithomiine-centred (*S. theaphia*) Group.	*Scada theaphia* . . .	5 ♂	5 ♂
Outside all synaposematic Groups.	*Hesperia syrichthus* . .	1	0
	Totals	323	325

* Three specimens have been mislaid. It is almost certain that they are males.

The extraordinary predominance of the Ithomiine-centred groups, especially the first, is well shown in Mr. Roberts' captures on these two days. Of course, an essential consideration is the nature of the locality in which he collected, viz., the clearing in the forest made and kept open for establishing and maintaining the road to the gold-mines. The butterflies were all captured upon the white flowers of *Eupatorium macrophyllum* which springs up wherever the forest is cleared. On these flowers in this situation the almost exclusive predominance of the Ithomiine-centred groups is proved by the whole results of collecting on two typical days, one (August 28) in the middle of the short, the other (February 23) in the middle of the long dry season. The extraordinary preponderance of males is also remarkable, and may be compared with the exhibit made by Dr. F. A. Dixey, in which the 153 *Pierinæ*—all males—were captured on wet mud. It is probable that these and other observations showing that the male is compelled to seek moisture, are to be explained by the fact that this sex flies in the sun far more freely than the comparatively retiring female.

Professor E. B. POULTON exhibited specimens referred to in the following notes by his assistant, Mr. W. HOLLAND, of the Hope Department:—

"Whilst sweeping in Stowe Wood, near Oxford, August 28, 1904, I brushed up a good many specimens of the little Halticid beetle, *Apteropeda orbiculata*, Mar., from the patches of *Ajuga reptans*, and with them at the same time the little Hemipteron, *Halticus apterus*, L., the last-named being most plentiful, and closely resembling the beetles with which they were mixed in the sweeping-net.

"On August 18, 1904, in searching at the roots of plants near Ascot-under-Wychwood, I found the same two insects in company, and experienced the same difficulty in picking out the beetles from the bugs.

"On April 13, 1905, when shaking some heaps of cut herbage lying beside the path from S. Hincksey to Chilswell Farm, near Oxford, a number of the little Staphylinid, *Myrmedonia canaliculata*, F., tumbled out on to the paper, together with many *Myrmica rubra*, race *ruginodis*, Nyl., the

beetle looking extremely like the ant. The same occurred in each heap which I searched. I then remembered having often seen the beetle and ant together under the large stones which lie by the path side in the walk to Henwood, on another part of the same hill. This latter observation is of course well known, but the former, seeming to show that the Staphylinids accompany the ants outside the nest, was new to me."

Professor POULTON observed that it was of great interest to obtain all possible evidence of association between mimic and model in the living state.

Mr. R. SHELFORD communicated the following "Note on a feeding experiment on the spider *Nephila maculata*."

Conclusions as to the relative tastefulness or distastefulness of insects derived from feeding experiments that are carried out with captive spiders or predatory insects must always be unsatisfactory; for the captives rendered ultra-ferocious by a new-found imprisonment will seize and devour almost everything in the nature of food that is offered to them, or else, wearied with a long imprisonment, become too languid to eat anything. I welcomed therefore an opportunity, that offered some little time ago, to test the predilections of a large spider living under perfectly natural conditions. In July 1902 I encountered the web of *Nephila maculata* stretched across a jungle path on Mt. Matang, in Sarawak, Borneo; occupying the centre of the web was a fine female specimen of this spider, and I employed two hours in catching examples of the insects flying about near the web, in placing my captures in the web and in noting down the behaviour of the spider. A heavy thunderstorm then drove me to shelter and in a short time totally wrecked the spider's web, so that the experiments are by no means as complete as I could wish. However, so far as they go, they are of some interest and appear worthy of a permanent record; they are set forth in tabular form herewith, the numbers in brackets referring to the numbers of specimens offered as food.

Insect offered as food.		Treatment by spider.
Hymenoptera	Trigona apicalis (5)	Thrown out of the web.
	Trigona lacteifascia (2)	One tasted, but then rejected; one thrown out of the web.
Coleoptera	Antipha sp. (1)	Tasted, and reserved for future consumption.
Hemiptera	Riptortus pedestris (2)	Instantly devoured.
	Cosmolestes picticeps (4)	Thrown out of the web.
	Velinus nigrigenu (1)	Thrown out of the web; great caution exercised.
Diptera	Musca sp. (1)	Instantly devoured.
Lepidoptera	Ypthima pandocus (7)	Instantly devoured.
	Cynitia diardi (1)	" "
	Terias hecabe (4)	One devoured, rest reserved for future consumption.
	Deilemera coleta (1)	Thrown out of the web.

In these experiments one feature was plain, viz. that the spider exhibited its likes and dislikes in the most unmistakable manner, and I am positive that its appetite was by no means sated by the time that the experiments had come to an untimely end. When the butterflies, *Ypthima pandocus* were thrown into the web the spider made a rapid rush at them, and in a moment the victims were engulfed. The Phytophagous beetle, a reddish-yellow species of *Antipha,* was instantly seized when it fell into the web, but the spider, after driving her falces into the body of her prey, then paused and appeared to find the copious yellow fluid which exuded from the body of the beetle highly distasteful; at any rate the beetle was not bitten again, but was spun up in a silken shroud and was suspended by a single strand of silk from the web. The method by which this beetle was enshrouded was interesting to watch. The spider held it by her front pair of legs and caused it to revolve by the help of her mouth parts,

whilst her hind pair of legs were applied one at a time to her spinnerets, bringing away at each movement a strand of silk which was then applied to the revolving beetle; the operation was carried out with great rapidity, and I could almost persuade myself that I was watching the movements of some ingenious silk-winding machine. When the beetle had become an amorphous bundle, one long strand was attached to it, the other end of the strand being held by one of the hind-legs; the spider then rapidly scaled its huge web, the silken bundle dangling from one leg, and attached the strand to one of the strands of the web. When my experiments came to an end four of the bundles were hanging from the web, one containing the beetle, the others specimens of the Pierine butterfly *Terias hecabe.* The first specimen of *Terias* put into the web was quickly eaten, but the other three were bitten and then wound up into bundles. If an insect was distasteful to the spider the strands in which it was entangled were cut, one of these strands was then caught up by one of the hind-legs of the spider, and after a few vigorous jerks of this leg the offensive insect was thrown clear of the web. The Reduviid bug *Cosmolestes picticeps*, a conspicuous black and yellow species, was thus treated; *Velinus nigrigenu* another, but larger, yellow and black Reduviid was approached with great caution, the spider just touched it with her palpi and started back as if alarmed, the strands of the web were cut in a wide circle round the prisoner so that a large hole was made, and the bug was jerked for some little distance away from the web; both these bugs were quite uninjured by their temporary imprisonment and soon managed to free themselves of the sticky silk in which they had been enmeshed. The small black bee with white-tipped wings *Trigona apicalis* was always thrown out of the web instantly, whereas the reddish species *T. lacteifascia* was in one case seized by the spider, but after it had been mouthed considerably was dropped in favour of a Muscid fly which then flew of its own accord into the web; a second specimen was rejected. It should be mentioned in this connection that the black and white species of bee is much more common than the reddish species and is mimicked very widely by Diptera, Coleoptera, other Hymenoptera and a

moth; the type of coloration is as typical a warning coloration as the red and black of the Lycidæ and the yellow bands of wasps; it was of interest then to note that the spider rejected the black and white bee without the slightest hesitation, whereas it tasted the less conspicuous red species. The common black and white moth *Deilemera coleta* was also thrown out of the web almost as soon as it was put in; this species is the only lepidopterous insect that I have ever found to be refused invariably by Mantidæ; it is an extremely common and conspicuous day-flying moth, and it was always a matter of surprise to me that it was not mimicked by species of other families of Lepidoptera.

The only other records of feeding experiments carried out with spiders that I am acquainted with, are those made by Mr. G. A. K. Marshall on *Nephilengys malabarensis*, Walck., in S. Africa; these are described in the Transactions for 1902 in Mr. Marshall's great paper on the bionomics of South African insects, and it is not necessary for me to quote them at length. The experimenter offered to five spiders various butterflies, some of which were denuded of their wing-scales, whilst others had their wings amputated. Mr. Marshall from his series of experiments concludes that spiders do not appreciate warning colours, and believes "that the toughness of inedible insects has been primarily developed to counteract the injuries from invertebrate foes (which are incapable of reasoning as to whether an insect is edible or not), and that therein lies its chief utility, though it may prove useful incidentally in other cases." My one experiment, if it does not show that *Nephila maculata* is capable of appreciating warning colours, does at least show that this species can recognize without preliminary tasting some of the insects distasteful to it; absolutely no hesitation was shown in rejecting five examples of *Trigona apicalis*, one of *Deilemera coleta* and four of *Cosmolestes picticeps*, but whether the colouring of these insects or their form was the feature determining their rejection by the spider is quite uncertain.

It is much to be desired that further feeding experiments on spiders be carried out, for they are almost the only insect enemies that can be experimented on under natural conditions.

The following papers were read:—"Some Bionomic notes on Butterflies from the Victoria Nyanza Region," with exhibits from the Oxford University Museum, by S. A. NEAVE, B.A.

"On the habits of a Species of *Ptyelus* in British East Africa," by S. L. HINDE, illustrated by drawings by Mrs. Hinde, communicated by Professor E. B. POULTON.

"Mimetic forms of *Papilio dardanus* (*merope*) and *Acræa johnstoni*," by Professor E. B. POULTON, D.Sc., F.R.S., Fellow of Jesus College, Oxford.

"Predaceous Insects and their Prey," by Professor E. B. POULTON, F.R.S.

"Studies on the Orthoptera in the Hope Department, Oxford University Museum. I. Blattidæ," by R. SHELFORD, M.A., F.L.S.

EXTRACTS FROM THE PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY OF LONDON

(October 3rd—December 5th, 1906).

Wednesday, October 3rd, 1906.

Commander J. J. Walker exhibited (1) a specimen of *Calosoma sycophanta* taken in Denny Wood, New Forest, June 16th; (2) *Lygæus equestris*, L., found in the Isle of Sheppey by Lieut. Jacobs, R.E., on September 22nd; (3) *Sitaris muralis*, taken near Oxford in August by Mr. A. H. Hamm; (4) two varieties of *Vanessa urticæ*, with a strong black ligament connecting the second costal and dorsal spot on the forewings, from the Isle of Sheppey, August; (5) a variety of *Argynnis adippe* ♂, caught at Tubney, Berks., on July 7th; (6) a slate-coloured variety of *Lycæna icarus* ♂, taken near Chatham, August 24th; and (7) examples of an almost entirely black form of *Strenia clathrata* occurring at Streatley, Berks., in August—all taken this year.

Dr. F. A. Dixey exhibited specimens of *Nychitona medusa*, Cram., *Pseudopontia paradoxa*, Feld., *Terias senegalensis*, Boisd., *Leuceronia pharis*, Boisd., and *L. argia*, Fabr., remarking upon them as follows:—

"Though there does not exist, so far as I am aware, any direct evidence that the members of the genus *Nychitona** are distasteful, their habits are such as to suggest this mode of protection; and there is, I think, little doubt that they have served as models for other insects. We find, for instance, a striking resemblance between the West African form of *N. medusa* called by Aurivillius *immaculata*, and the remarkable insect *Pseudopontia paradoxa*, Feld., as to whose affinities I will not venture to offer an opinion. Both forms are

* I employ Dr. A. G. Butler's name for a genus which has been variously known as *Pontia* and *Leptosia* by different authors.

inhabitants of the same tropical coast region, and it may well be anticipated that future observation will show their likeness in appearance to have a mimetic significance. I would suggest also that the white form of the female *Terias senegalensis*, Boisd., which occurs not uncommonly in some parts of Africa, may owe its peculiar aspect to a similar cause. Specimens of this form of the female from the Victoria Nyanza, together with an ordinary yellow male from the same district, are here exhibited.

"But probably the most remarkable and unmistakable case of mimetic approach to the *Nychitona* as a model is that afforded by *Leuceronia pharis*, Boisd., to which I incidentally drew attention in reference to an exhibit recorded in our Proceedings" for 1906, p. xxxi. As I remarked on that occasion, the genus *Eronia* (including *Nepheronia* and *Leuceronia*) has been so strongly affected by mimetic transformation that it can scarcely be said to have an aspect of its own. The male, however, of *L. argia*, Fabr., is probably as characteristic of the genus as any other form, and a specimen has accordingly been placed by the side of *L. pharis*, to which it is closely related. Few observers will, it is believed, remain unconvinced that *L. pharis* represents a departure, of mimetic significance, in the direction of *Nychitona*. That the latter genus rather than the former has served as the model might be expected from its very wide range and generally uniform characteristics. This is no doubt really the case, but with a qualification.

"Several years ago I tried to explain certain curious phenomena of mimicry in South American butterflies, by supposing that a mutual interchange of features was liable to take place between distasteful forms—a give-and-take arrangement which I then called 'reciprocal mimicry,' and for which Prof. Poulton has since proposed the more accurate term 'diaposematism' (Trans. Ent. Soc. Lond., 1894, pp. 296–298; *ibid.* 1896, pp. 72–75; *ibid.* 1897, pp. 324–331. See also Presidential Address by Mr. Trimen, Proc. Ent. Soc. Lond., 1897, pp. lxxx, lxxxi). The principle thus suggested has since been found by Mr. G. A. K. Marshall, Prof. Poulton, Mr. Neave and others to be applicable in many other cases than those which first led me to its formulation, and I venture to think that it may now be taken as a well-established law

(Trans. Ent. Soc. Lond. 1902, pp. 296, 489, 490; *ibid.* 1906, pp. 216–218, 292–3). It will be seen from what follows that the present exhibit probably furnishes a fresh instance of its operation.

"The resemblance of *L. pharis* to the ordinary African forms of *Nychitona*, though striking, is not exact. The *Leuceronia* has no dark discal spot, the outline of the dark apical border of the fore-wing is more regular, and the texture of the wings is more solid-looking and opaque than in the prevailing forms of the model. But among the specimens of *Nychitona* collected by Mr. Wiggins in the neighbourhood of the Victoria Nyanza and worked out by Mr. Neave in 'Novit. Zool.,' Vol. XI, 1904, p. 324, there occur some forms which in all these respects correspond with the mimic rather than with the usual type of the model. The inference seems clear that although the part played by the *Leuceronia* has been chiefly that of a borrower, it has in return bestowed certain features of its own upon this particular race of its model. The form of *Nychitona* in question, a specimen of which is included in the exhibit, may possibly deserve to rank as a distinct sub-species.

"Whether the aspect of the purely white specimens of *Nychitona* from West Africa here shown in connection with *Pseudopontia* affords another instance of reciprocal change, I am not prepared to say, especially as similar forms occur in districts where *Pseudopontia* is not met with. But on looking at the genus as a whole, it would appear to be significant that whereas in India, where, so far as we know, *Nychitona* is not mimicked, its forms present a very uniform appearance with the characteristic discal spot and irregular apical border conspicuously present, in Africa we find variations of *Nychitona* each of which tends to bring it into more or less close correspondence with a probable mimic. On these grounds it seems not unreasonable to seek for an explanation of the facts in the direction of diaposematic change."

Mr. W. J. Kaye read "Some Notes on the Dominant Müllerian Group of Butterflies from the Potaro River District of British Guiana."

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Wednesday, October 17th, 1906.

Mr. W. J. Kaye exhibited a fine example of the remarkable moth *Draconia rusina*, Druce, from Trinidad. The species bears a wonderful resemblance to a decayed dead leaf, the patches on the wings also suggesting the work of some leaf-mining insect. The margins of the wings were so deeply indented as to make it appear that the specimen was greatly damaged. The species was originally described by Druce from Guatemala in the "Biol. Cent. Am. Heterocera," p. 188, and was figured on Plate IX, fig. 9. There it was placed in the Siculodidæ, a small family created to include a few allied species, but was put into the Thyrididæ by Hampson, the family embracing the Siculodidæ. On imaginal characters the insect was undoubtedly a Thyridid, although in general appearance wholly different from the two European Thyridids. The specimen exhibited, and also figured for the Society (Plate XXXII), had been found at rest on the ground. But it was probably a night flyer as the exhibitor had taken one or two other related species in British Guiana at night.

Dr. F. A. Dixey exhibited specimens of *Ixias baliensis*, Fruhst., and *Huphina corva*, Wallace, remarking upon them as follows :—

"Some short while since, a few Pierine butterflies from the Island of Bali, which formed part of a collection kindly presented to the Hope Department by their captor, Mr. R. Shelford, were put into my hands for incorporation with the general series. The butterflies when they reached me had been set up, and, as was supposed, had been sorted into species. Among a somewhat worn series of the Malayan form (*H. corva*, Wallace), of *Huphina nerissa*, Fabr., one female caught my eye as being in rather better condition than the rest. On being examined more closely, it was seen to be not a *Huphina* at all, but an *Ixias* ; a genus, as I need hardly say, of very different affinities. The specimen is, in fact, a female of the Bali form of *Ixias reinwardtii*, Voll. ; the form which has been called *baliensis* by Fruhstorfer. It is quite near enough in appearance to the *Huphinas* with which it was

caught to pass muster easily on a casual view; and, as has been seen, it did actually delude one human observer.

"There can, I think, be little doubt that this resemblance is significant. The usual aspect of *Ixias* is rather widely departed from by both sexes of *I. reinwardtii* and its immediate allies, but, as so often is the case, the mimetic approach to another genus is confined to the female. Through the kindness of Professor Poulton I am able to exhibit a male example of *Ixias baliensis* which is especially interesting as being one of the actual specimens caught by Mr. Wallace during his memorable visit to the Malay Archipelago. It will be seen that the male has no share in the mimetic garb of his mate.

"It is noticeable that the appearance of these specimens of *H. corva* from Bali differs from that of ordinary examples of *H. nerissa* in the fact that the hind-wing of both sexes shows a rather pronounced dark border; this in the female being brought about by an almost complete fusion of the submarginal row of dark spots, commonly found in that sex of the species, with the dark margin itself. This brings the hind-wing of the model into close correspondence with that of the mimic, a correspondence which does not exist in the case of the usual form of the model. It is of course conceivable that this special feature in the *Huphina* is merely accidental; but in view of the fact that a similar condition is usual in *Ixias*, whereas in *H. nerissa* it is practically confined to the particular form that is mimicked by *Ixias*, it seems more explicable as a case of diaposematism—a principle which experience is continually showing to be very widely prevalent.

"In this instance the *Huphina* has on the whole acted as the model, under whose influence the *Ixias* has drifted some distance away from the usual aspect of its genus. But in the particular case of the hind-wing the process is reversed; the *Ixias* has been the model, and has in its turn been mimicked by the *Huphina*.

"We have some direct evidence that *H. nerissa* is disliked by insectivorous birds. I am not aware of any such evidence in the case of *Ixias*. But if the foregoing conclusions are well founded, the association between the two must necessarily be Müllerian and not Batesian."

Mr. S. A. Neave exhibited a number of Lepidoptera selected from the collection made by him in N.-E. Rhodesia, in 1904 and 1905, comprising the following rare and remarkable species:—

Melanitis libya, Distant; *Liptena homeyeri*, Dewitz; *Pentila peucetia*, Hew.; *Catochrysops gigantea*, Trim.; *Crenis pechueli*, Dewitz, and *Crenis rosa*, Hew., which are evidently two distinct species; and *Crenidomimas concordia*, Hopff., the mimic of the last two species. Also two remarkable species of the genus *Aphnæus*—including a female, so rarely taken in this genus—*Acræa natalica*, Boisd., and *Acræa anemosa*, Hew., with two remarkable moths showing a close mimetic resemblance to them.

The exhibitor further stated that his collection would, he thought, prove exceedingly interesting as regards seasonal forms especially in the Acræinæ and Pierinæ, of which he showed examples.

(*a*) *Acræa acrita*, Hew.—Dry, intermediate and wet phases of both sexes; the wet-season specimens were highly remarkable, being, especially in the females, nearly black.

(*b*) *Acræa chæribula*, Oberth., taken in the height of the dry season; remarking that:—

" Dr. Butler * has suggested that *chæribula* with its heavy black apex may be the wet-season form of *acrita*. The specimens shown seemed to demonstrate fairly certainly that this is not the case. At the same time, an examination of the series in the British Museum left it doubtful whether the specimens there recorded by him under that name are the true *chæribula* of Oberthür. They appear to be only variations of *acrita* which, apart from its seasonal phases, is undoubtedly a highly variable species."

(*c*) *Acræa natalica*, Boisd.—Dry and wet phases of both sexes; the dry specimens being characterized by their smaller size and slightly brighter colour.

(*d*) *Acræa induna*, Trim.
A. doubledayi oncæa, Hopff.
A. caldarena, Hew.
— Dry and wet phases of both sexes, all exhibiting a tendency, especially the females, to a darker colour in the wet season.

* P. Z. S. 1894, p. 566.

Commenting on these species Mr. Neave said that he had found the above change of colour in the seasonal phases, which is common to all the above species, but is most marked in *acrita*, exceedingly difficult to account for. The very strongly aposematic coloration of this species in the dry season when the struggle for existence is keenest is most notable. It was, he thought, at this time of year, the most brilliant insect on the wing that he knew. The change of colour is also accompanied to some extent by change of habit, dry-season specimens being much more restless and hard to capture than wet ones. It seemed therefore difficult to account for these facts without supposing that the brilliant dry-season phases have been evolved, by stress of circumstance at that time of year, from a duller coloured phase such as, in this region, we still find in the wet season when the struggle is not so keen.

Seasonal forms in the Pierinæ were represented by :—

(*e*) A long series of *Teracolus regina*, Trim., of both sexes and of *Teracolus phlegyas*, Butler. "The dry season ♀♀ of *regina* remarkable for having the brilliant purple apical tip of the ♂ much more strongly represented in dry-season specimens than in wet."

The distribution of these two species in this particular region was of interest, inasmuch as the exhibitor had never taken both in the same locality. *T. phlegyas* appeared to be entirely confined to the hot dry river valleys and low country up to 2000 feet, whilst he took *regina* commonly in the more hilly uplands from 2000 feet upwards.

(*f*) *Teriomima hildegarda*, Kirby, dry, intermediate and wet phases. A rare phenomenon in African Lycænidæ.

Mr. G. A. K. Marshall, with reference to the seasonal changes in *Acræa*, expressed the opinion that the increase of the blackish markings, which is so usual a feature in the summer ♀♀, tended to make the insects less conspicuous on the wing and probably had a procryptic significance. This might be due to the fact that that was the season of oviposition when the ♀♀ might require special protection, even in the case of distasteful species. With regard to Mr. Neave's remarks on the brilliant colouring of *A. acrita* in the dry

season he pointed out that in Rhodesia the species of *Acræa* fall roughly into two groups in this respect, namely: (1) the larger or more high-flying species, such as *acrita*, *anemosa*, *atolmis*, etc., which presented a more brilliant appearance in winter; this being probably due to their greater unpalatability, which had been to some extent shown by experiments, and which would render a bright aposematic coloration of considerable utility at this season of greater stress; and (2) the smaller, low-flying, and less unpalatable species, such as *axina*, *asema*, etc., which could not afford to make themselves too conspicuous at such a time and whose colouring therefore tended more to harmonise with the dull reds and yellows of the withered grasses among which they flew.

The question however of the significance of the black markings in *Acræa* was complicated by the fact that in several widely-distributed species there was a progressive local increase in the black from south to north, irrespective of season.

Professor E. B. Poulton, F.R.S., congratulated Mr. Neave upon his interesting exhibition. He made a few remarks upon the melanic forms of the wet season, but expressed himself unable at present to understand the full significance of the changes. In conclusion, Professor Poulton asked Dr. F. A. Dixey whether it was likely that the females of *Teracolus regina* exhibited in one season a synaposematic approach to the females of other and very distinct species of the same genus; in the other season a similar approach to *Pierinæ* of a remote genus.

Dr. F. A. Dixey said that he was not at present prepared to give a complete answer to the question put to him by Professor Poulton. The seasonal changes of *Teracolus regina*, in relation to the sexual dimorphism of that species, were very remarkable and required further investigation. He had, however, no doubt that both in this species and in *T. phlegyas* the dry-season form of both sexes had a cryptic character, at any rate in the resting position of the insect. He was quite convinced of this in the case of the last-named butterfly and of its congener, *T. speciosus*, from having watched both species under natural conditions.

Wednesday, November 7th, 1906.

Mr. H. J. LUCAS exhibited a photograph of *Panorpa germanica*, practically immaculate, taken by Mr. E. A. Cockayne, a Fellow of the Society, at Tongue, Sutherlandshire, now in the Hope Museum, and a typical form for comparison, corresponding apparently to the *borealis* of Stephens. He also showed a series of *P. germanica* to illustrate the range of spotting on the wings of both sexes, with two ♂ ♂s and two ♀ ♀s of *P. communis*; and a pair of a third species, *P. cognata*. The first two species are common; the third scarce.

Dr. F. A. DIXEY exhibited several specimens of Pierine butterflies in illustration of melanism, and made the following remarks:—

"At the recent meeting of the British Association in York, much interest was aroused by Mr. Porritt's paper and exhibit on the subject of melanism. It has occurred to me that an illustration of some of the general conditions under which white and other kinds of pigment may be replaced by black might possibly aid in the consideration of the more special question as it affects the insect-fauna of these islands. With this view I have brought some selected specimens here to-night, and propose, while enlarging the scope of inquiry in one way, to narrow it in another by confining my illustrations to the group of *Pierinæ*.

"A substitution of dark pigment for light may take place—

"(1) Between allied species, as *Belenois mesentina*, Cram., and *B. raffrayi*, Oberth.

"(2) Between nearly-related forms of the same species, as *Eronia cleodora*, Hübn., from East London, and *E. cleodora*, f. *dilatata*, Butl., from Mombasa.

"(3) Between the sexes of the same species, as *Delias inferna*, Butl., ♂ and ♀.

"(4) Between individuals of the same sex of the same species, as the ordinary and 'white' form of *Colias electra*, Linn., ♀.

"It is often possible to trace a connection between dark

pigmentation and certain external or internal conditions, such as horizontal or vertical distribution, season and sex. Can any of these conditions be regarded as a direct cause of melanism?

"(1) As instances of the influence of horizontal distribution, or locality, we have *Eronia cleodora* as above; *Belenois mesentina* of Africa and India with its Australian representative *B. teutonia*, Fabr.; and *B. severina*, Cram., ♀ from Natal compared with *B. severina* ♀ from the Victoria Nyanza.

"(2) As examples of the influence of vertical distribution we may take *Tatochila autodice*, Hübn., ♀ from Buenos Ayres, and *T. stigmadice*, Stdgr., ♀ from the Andes of Ecuador. A familiar case of the same kind is the ordinary *Ganoris napi*, Linn., ♀ of Switzerland compared with *G. bryoniæ*, Ochs., of the high Alps.

"(3) To illustrate seasonal influence we may compare the dry- and wet-season forms of *Teracolus annæ*, Wallgrn., *T. antigone*, Boisd., *T. omphale*, Godt., *Glutophrissa saba*, Fabr., *Appias libythea*, Fabr., *Tachyris hippo*, Cram., *Huphina nadina*, Luc., *H. nerissa*, Fabr., and *Ixias evippe*, Drury. In all these the tendency towards melanism in the rains shown by the females is well marked. The corresponding males are also affected, though in less degree.

"(4) As exemplifying the influence of sex, we have *Delias inferna* ♂ and ♀ as above, *D. descombesi*, Boisd., *D. eucharis*, Drury, *Terias tominia*, Voll., and *T. zita*, Feld.

"It seems obvious that in all these cases there must be some relation or other between the increase of dark pigment and the conditions that have been named. But is the bond between them one of direct causation? It will be found that the attempt to rank any one of these conditions as an actual and immediate cause of melanism is attended with great difficulty.

"(1) Melanism cannot be purely a matter of different climatic conditions dependent on horizontal distribution, because in any given region it often happens that only one sex shows a tendency towards melanism, the other sex remaining unaffected. Moreover, as in the case of *Belenois mesentina* and *B. raffrayi*, we may have two closely allied butterflies from the same locality, one nearly white and the other almost black

"(2) Nor is it easy to consider melanism as a direct consequence of high altitude, for here again it is often only the one sex that is affected, as in *G. bryoniæ.* Besides this, female *G. napi* of the ordinary kind may be found in the same localities as *G. bryoniæ*; and 'white' butterflies which are met with at enormously high altitudes, such as *Baltia shawii*, Bates, ♂ in Central Asia and *Phulia nymphula*, Blanch., in the Andes, are by no means melanic. Again, the female of *Tatochila demodice*, Blanch., shows dark pigmentation whether taken at high altitudes or at the sea-level.

"(3) There is obviously a strong connection between seasonal conditions and melanism. This is clearly shown by the series of seasonal forms in the present exhibit. As a rule, the deeply-pigmented form belongs to the wet season, and the paler form to the dry. But here again, if we attempt to make wet-season conditions a direct cause of melanism, we are met by the fact that sometimes the same conditions are associated with an exactly opposite result. The instance of *Precis octavia-natalensis* and *sesamus* will occur to every one as a case in point; but without travelling beyond the *Pierinæ* we have only to compare the under-sides of, say, *Ixias pyrene*, Linn., ♂, wet and dry, or of *Terias senegalensis*, Boisd., ♂ wet and dry, to see that an increase of dark pigmentation, whether in a diffused or concentrated form, may characterise a dry-season phase as opposed to a wet one. A further difficulty is that dark pigmentation appears in some instances (as in *Polyommatus phlæas*, var. *eleus*) to be an accompaniment of heat, in others (as in *Vanessa urticæ*, var. *polaris*) of cold.

"(4) Lastly, with regard to sex. It is no doubt true that in the majority of instances the female shows a darker coloration than the male. This comes out well in many of the specimens exhibited. But it is not difficult to find examples of the reverse condition, where the female possesses less dark pigment than her mate. This is the case, for instance, with some forms of *Colias eurytheme*, Boisd., and with *Dismorphia thermesia*, Godt.

"It seems therefore difficult to attribute melanism, or the tendency towards that condition, to the immediate action of either geographical or seasonal conditions or to the direct

influence of sex. What explanation remains? I am strongly disposed to think that in the vast majority of cases the prevalence of dark pigmentation is adaptive, and that although melanism in its various degrees may certainly originate as a variation or a sport, its increase and establishment are to be attributed to some form of selection. Any one of the conditions mentioned may by itself, or in combination with others, favour melanism; not however by direct causation, but by indirectly leading to the selection of melanic individuals. Thus, there is little doubt that the dark pigmentation is in many cases of advantage as aiding concealment. This is probably the explanation of many instances of dull or dark coloration in the female sex not only of insects but of other animals, it being well known that the female sex stands in special need of protection (Wallace). The writer has observed that the darkly-pigmented female of *Belenois severina*, a common African form, is far less conspicuous on the wing than the lighter-coloured male. The dark border indeed of the former sex is often hardly visible, and the general impression given is that of a much dwarfed specimen, though the average female is not really smaller than her mate. An enemy attacking such forms on the wing might, it is believed, avoid the apparently dwarfed specimens, either because they afforded less prospect of a sufficient meal, or (in accordance with a suggestion of Mr. F. A. Heron) because, apparent size being a correlative of distance, the attacker might be deluded into supposing the black-bordered forms to be further away and so less easily reached than the rest.

"It is noticeable that in some cases of heavily-pigmented wet-season forms, the under-side shows no corresponding melanism, being often in fact far lighter in colour than the under-side of the same species in the dry season. This exact reversal of effect on the two surfaces is of itself a strong argument against the supposed direct operation of meteorological conditions in producing melanism. Such conditions, as I have elsewhere urged, and as has been amply proved by experiment, may act as a liberating stimulus; but only rarely, if at all, can they be looked upon as a direct cause of darkened pigmentation. I would not entirely deny their direct effect

upon the individual, nor even that such direct effect may under some circumstances reappear in the offspring. Weismann's results with *P. phlæas*, Fischer's with *Arctia caja*, and others on record (see Schneider, "Einführung in die Deszendenz-theorie," 1906, p. 113, etc.) seem to demonstrate the possibility of such apparent transmission. But this phenomenon of the diverse effect upon the two surfaces, together with the other considerations already brought forward, appears to make strongly against the hypothesis of a direct effect; and to favour, as far as it goes, the view that such changes as these are adaptive.

"A further point of interest arises in connection with the common absence of dark pigmentation on the under-side of wet-season forms, even when the upper surface is strongly melanic. It is this: that on comparing the seasonal phases of such forms we are often led to the conclusion that so far as the upper-side is concerned the wet-season form is better protected, but with regard to the lower-side the corresponding dry-season phase, being cryptically coloured, has the advantage. This may mean that the wet-season form requires more protection during flight, and the dry-season form during repose; and this again may point to the fact that it is such enemies as attack butterflies at rest (for example, lizards) that are especially dangerous during the drier part of the year.

"Whether the duskiness so often met with in arctic and mountain forms can at present be explained as an adaptation, is perhaps doubtful; though there seems to be no reason why Lord Walsingham's suggestion of its relation to the power of heat-absorption should not be correct. In such cases of the development of dark pigment as we see in females of *Mylothris lorena*, Hew., *M. pyrrha*, Fabr., *Pieris demophile*, Clerck., *P. viardi*, Boisd., *P. locusta*, Feld., *P. tithoreides*, Butl., etc., to which may probably be added the wet-season *Glutophrissa saba* ♀ (see Trimen, Proc. Ent. Soc. Lond., 1881, p. viii), the influence at work is that of mimicry, and the result clearly takes rank as an adaptation.

"The occasional predominance of dark pigment in the males as compared with their mates is apt to show itself in the form of distinct and definite areas—not in that of suffusion. A

common effect therefore on the male is to make that sex not less, but more conspicuous. Hence the pigmental areas may possibly in these cases serve as recognition-marks.

"This last, however, is but a suggestion. I am far from saying that the advantage of a melanic tendency to its possessor is in every instance demonstrable. I only submit that our present knowledge, so far as it goes, points to selective adaptation as the principle which seems likely to cover most if not all of the diverse conditions now grouped together under the comprehensive head of melanism."

The PRESIDENT said he thought there was no doubt that temperature had, what appeared to be, a direct effect in the case of many Lepidoptera. For example, on many of the common Geometrid moths, if the pupæ were exposed, some to a temperature of 40° to 50°, others to one of 70° to 80°, those at the lower temperature were darker.

Professor E. B. POULTON, Dr. T. A. CHAPMAN, Mr. W. E. SHARP, Mr. W. J. LUCAS, and other Fellows joined in a discussion of the spread of melanism in various districts of Britain and elsewhere.

Wednesday, November 21st, 1906.

Dr. F. A. DIXEY exhibited dry- and wet-season forms of both sexes of *Teracolus regina*, Trim., together with specimens of *Belenois calypso*, Drury, *B. thysa*, Hopff., *Mylothris agathina*, Cram., and two unnamed forms of *Belenois* from Rhodesia.

The exhibit was designed to show the strong resemblance between the under-side of the wet-season phase of *Teracolus regina* and that of certain forms of *Belenois* from the same region of Africa—a resemblance believed by the exhibitor to be of mimetic significance. He pointed out that between *B. calypso* and *B. thysa*, which latter was an acknowledged mimic of the distasteful *Mylothris agathina*, there existed a fairly complete series of transitional forms, one of which at least showed on the under-side a striking resemblance to the under-side of the wet-season *T. regina*. It seemed as if *M. agathina*

had exercised a strong influence on this group of *Belenois*, and that in the progress of these *Belenois*-forms towards the final mimetic pattern shown by *B. thysa*, one of them had, as it were, taken up *T. regina* in its course. The association between the *Belenois* and the *Teracolus* was probably Müllerian, the *Belenois* being in most respects the model; but it was perhaps not improbable that the *Teracolus* had to some extent influenced the *Belenois*. These specimens seemed to favour the view that *B. thysa* was a Müllerian rather than a Batesian mimic. It was an interesting fact that the cryptic character of the dry-season form, as well as the mimetic appearance of the wet-season phase of the *Teracolus*, was confined to the under surface; being presumably in both instances intended for use during rest rather than in flight. As in other cases, the dry-season form was probably the more efficiently protected. It might be taken as a general rule that in cases of seasonal dimorphism, if one phase only were protected, that phase would be the dry-season one; if both adopted means of defence differing in degree or in kind, the dry-season phase would be the better protected of the two.

Professor E. B. Poulton, F.R.S., communicated some "further notes on the choice of a resting site by *Pieris rapæ*," by Mr. A. H. Hamm, as follows:—

"On July 10th this year I observed a male of this species at rest on the under-side of a dahlia leaf in my garden, 22 Southfield Road, Oxford. In no case had the dahlias bloomed by this date. The *Pieris*, although it had not chosen the best possible site in the garden, was fairly well hidden amid the thick foliage. The only other occasion on which this species was seen at rest in 1906 was on August 4th, when my friends, Mr. Holdaway and Mr. Constance, and I were sugaring in the "Decoy," Newton Abbot, S. Devon. During the rounds many trees, bushes, &c. were searched with the aid of our lanterns for any strange insects at rest upon the foliage. My attention was first directed by Mr. Constance to a specimen of *P. rapæ* at rest upon the whitish under-side of a leaf of the broad-leaved sallow (probably *Salix capræa*). After this we all three began a more systematic search, and succeeded in finding four additional individuals of the species. The five

butterflies were distributed as follows:—Two were on the under-sides of leaves of the broad-leaved sallow; two on bramble leaves (one hanging from the under-side, and the other sitting on an under-side which happened to be turned uppermost); the fifth was found hanging from the under-side of a leaf on a birch bush. The under surface of all these leaves is very pale as compared with the upper surface. These facts seem to me to strengthen the opinion expressed in my former notes (vide "Proc. Ent. Soc. Lond." 1904, p. lxxv, and 1905, pp. lxxiii, lxxiv) that *Pieris rapæ* does select for prolonged rest a site adapted to promote concealment."

Papers.

"A Permanent Record of British Moths in their Natural Attitudes of Rest," by Mr. A. H. Hamm, Assistant in the Hope Department of Zoology in the Oxford University Museum, communicated by Professor E. B. Poulton, F.R.S.

"Studies of the Blattidæ," by R. Shelford, M.A., F.L.S.

Wednesday, December 5th, 1906.

Dr. F. A. Dixey exhibited specimens of *Teracolus omphale*, Godt., bred and captured at Salisbury, Mashonaland, by Mr. G. A. K. Marshall, F.Z.S. The exhibit was intended to show the effect of subjecting the insects during their immature stages to abnormal conditions of temperature and humidity.

He pointed out that the members of a brood which had been reared under ordinary conditions as larvæ, but had been exposed as pupæ to damp heat, showed on emergence little or no difference from those examples that had been reared under normal conditions throughout. The emergences took place in June 1905, and the resulting butterflies were of the usual dry-season phase, though less markedly dry-season than a pair captured in the field at the same date.

On the other hand, several examples, belonging to one brood, had been brought up as larvæ in an atmosphere of damp heat, from which they were removed on pupation into natural conditions. The resulting butterflies, emerging in July during

the height of the dry-season, were on the upper-side almost of the wet-season phase, while others of the same brood which had been kept in damp heat throughout both the larval and pupal stages went still further in the same direction. Some of these latter indeed, especially the females, showed on the upper surface the wet-season pattern fully developed. On the under surface the approximation to the wet-season phase was somewhat less complete; the most advanced examples of the effect of exposure to damp heat during both preliminary stages still exhibiting beneath some slight trace of the dry-season mottling. On the whole, however, very little difference was apparent between these artificially-produced wet-season forms and specimens which were shown of the normal wet-season phase captured in the open before the cessation of the rains.

Dr. DIXEY further remarked that Mr. Marshall was to be congratulated on having been the first to produce, in tropical species of *Pierinæ*, results as definite and unequivocal as any of those obtained by the President, Staudfuss, Fischer and others in European lepidoptera. Mr. Marshall had conclusively shown in the case of the present species that the natural stimulus for the assumption of the wet-season phase could be successfully imitated under artificial conditions; he had also proved experimentally that while both preliminary stages were to some extent capable of reacting to external conditions, by for the most susceptible period must be contained within the larval stage of growth. The conclusions foreshadowed by Mr. Marshall's earlier experiments with *T. omphale* (Trans. Ent. Soc. Lond., 1902, pp. 211–213) were thus fully confirmed and amplified. These facts appeared to be of so much interest as to justify their immediate communication to the Society; he hoped before long to be in a position to present the results of a further examination of Mr. Marshall's valuable material.

Mr. G. A. K. MARSHALL said that his experiments showed that the larval period, especially in its later stages, was in *Teracolus* the period in which the insect was most sensitive to the above influence; the pupa stage, which was the most sensitive stage in *Precis*, being almost insensitive.

The PRESIDENT drew attention to the extreme interest of these experiments, and congratulated Mr. Marshall on the

success which had attended his researches, conducted as they were under great difficulties in Central South Africa.

Dr. Frederick Augustus Dixey, M.A., M.D., communicated a paper "On the Diaposematic Resemblance between *Huphina corva*, Wallace, and *Ixias baliensis*, Fruhst."

EXTRACTS FROM THE PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY OF LONDON

(March 6th—December 4th, 1907).

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Wednesday, March 6th, 1907.

Exhibitions.

Male Brands attacked by Pests.—Professor E. B. Poulton, F.R.S., exhibited male specimens of the Danaine butterflies *Amauris egialea*, Cram., and *Limnas chrysippus*, L., collected at Ibadan, near Lagos (December 5–12, 1906), by Mr. H. S. Gladstone. The interest of the specimens lay in the fact that the scent-producing patch near the anal angle of the hind-wing had been eaten out on both sides—very cleanly and neatly in the case of the *Amauris*—although only a minute portion of any other part of the wing-surface had been attacked. The abdomen was almost entirely wanting, but the basal portion which remained showed that it had been almost certainly devoured. The head and thorax also appeared to be quite empty. Professor Poulton stated that he had occasionally observed the evidence of such attacks upon the supposed scent-patches of *Danainæ*, but he believed that the *Amauris* was the best and clearest case he had ever seen. This special attack upon *Danaine* scent-patches becomes of even greater interest and significance when we remember that dead specimens of this and the allied sub-family, the *Ithomiinæ*, are less liable than other specimens to be injured by the pests which destroy insect collections.* On the other hand, the fact that the whole interior of the body was devoured appears to indicate indifference on the part of this particular pest to any specially protective substances existing in a desiccated state;

* H. W. Bates, Trans. Linn. Soc. Lond., vol. xxiii, 1862, p. 510 ; R. Meldola, Proc. Ent. Soc. Lond., 1877, p. xii. Confirmed also by J. Jenner Weir.

and it may well be that special attack was directed upon the scent-glands merely on account of their substance as compared with the rest of the wing surface. The facts appear to tell strongly against the view that specially protective (aposematic) substances are, as some have supposed, concentrated in the male scent-glands; but it would not be safe to draw any more far-reaching conclusions.

Inasmuch as an alternative view has been mentioned, it may be advantageous to quote the following passage from a paper published in 1882 by Professor Meldola, F.R.S. (Ann. Mag.

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Nat. Hist., Dec. 1882, p. 425). Writing in answer to Mr. W. L. Distant, Professor Meldola states:—

"There is not the least warrant for the supposition that scent-glands or tufts have anything to do with distastefulness. The acrid juices of distasteful butterflies are not generally emitted from any particular organ, but permeate all the tissues of the body. The fact that such organs exist in one sex only is strongly suggestive, if not demonstrative, of the view that they are *secondary sexual characters;* and as such they are regarded by Dr. Fritz Müller, who has systematically investigated these structures, and has in many cases actually detected the odour emitted, which is often of a pleasant character." (Jen. Zeit., vol. xi, p. 99; Trans. Ent. Soc. Lond. 1878, p. 211.)

Remarkable Larva of Spiramiopsis.—Professor E. B. Poulton also exhibited on behalf of Mr. G. F. Leigh, F.E.S., of Durban, a blown specimen of the larva of *Spiramiopsis comma*, Hampson, showing the two pairs of remarkable processes as well as the two eye-like spots, one situated in front of the base of each posterior process. The anterior pair are placed on the second thoracic segment, the posterior on the third. In the dried specimen the ground-colour of the dorsal and dorso-lateral regions of each of these segments is of a brilliant orange-brown tint, making a most effective background for the intensely black, nearly circular eye-like spots. The effect of these latter is also greatly enhanced by a dark semi-circular line placed outside a margin of orange embracing nearly half the circumference of each spot. This

line, which is concentric with the eye-spot, bounds it upon the posterior-inferior section of its circumference. A sketch sent by Mr. Leigh in further explanation of his exhibit shows that, when touched, the larva curves the anterior segments so as to conceal its real head and make the central point between the eye-spots anterior in position. From this central point the four relatively immense processes radiate like spokes, while the bright orange colour and jet-black eye-spots placed on each side of the centre must contribute with them to produce an extraordinary and terrifying appearance. By Mr. Leigh's desire the specimen will be placed beside the imagines
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of the same species in the collection of the British Museum of Natural History. The larva bears the date :—" Durban, Nov. 3, 1906."

Effect of Artificial Conditions on Seasonally Dimorphic Species.—Dr. F. A. Dixey exhibited specimens of *Teracolus achine*, Cram., and *Belenois severina*, Cram., bred and captured at Salisbury, Mashonaland, by Mr. G. A. K. Marshall.

He remarked that the exhibit, which was supplementary to that shown by him on December 5th (Proc. Ent. Soc. Lond., 1906, p. civ), provided a further instalment of the results of Mr. Marshall's valuable experiments on the effect of artificial conditions on seasonally dimorphic species. In the case of *Teracolus achine*, the exposure to conditions of moist heat in both larval and pupal stages had caused both sexes of a brood that should normally have emerged as the dry-season form, to assume the appearance of a wet-season generation. The same conditions operating in the larval stage alone had produced a close approximation to the same result; while in specimens which had been similarly treated in the pupal stage only, little or no departure could be seen in the direction of the wet-season form. Specimens of both seasonal phases caught in the open were exhibited for comparison, and it was pointed out that these results with *Teracolus achine* showed complete correspondence with those previously announced in the case of *T. omphale*, Godt.

The behaviour of *Belenois severina* contrasted strongly with that of the two species of *Teracolus*, for whereas in the case of

the latter the larval was proved to be the susceptible period, exposure of the former to damp heat in the larval condition produced no perceptible effect, the resulting emergences being of the ordinary dry-season phase. Exposure, however, to the same conditions in both larval and pupal stages resulted in a transformation to the full wet-season form. In this species the seasonal changes chiefly affect the under-surface.

A further point of great interest received illustration from the same series of bred *B. severina.* This was the difference in effect between moisture accompanied by heat and moisture alone. Those individuals exposed as both larvæ and pupæ to the combined effect of heat and moisture, emerged, as has been said, in the full wet-season condition. Those, on the other hand, exposed in both these stages to moisture alone without heat, emerged with the ground-colour of the hind-wing underside characteristic of the wet season, while the dark veining of the dry season was in the same specimens not only present but strongly accentuated. It might be said, in fact, that the employment of moisture only, without heat, had produced a well-marked form, unknown under normal conditions in this region, though occurring naturally in some other parts of Africa, as Uganda and Natal.

To sum up: Mr. Marshall by means of these carefully conducted experiments had shown that in the two species of *Teracolus*, *T. omphale* and *T. achine*, a brood which left to itself would produce the dry-season phase of the imago, might by the application of heat and moisture be made to assume the characteristic features of the wet-season form. Further, in each of these cases it was shown that exposure to the artificial conditions during the larval stage only was capable of producing nearly the whole effect, the result of similarly treating the pupa only being scarcely perceptible.

On the other hand, while in *Belenois severina* an equally complete transformation from the dry- to the wet-season form had been accomplished, it was clearly shown that in this case the larval was not the susceptible stage, the result of exposing the larva only to the artificial conditions being practically *nil.* In this species also Mr. Marshall had experimentally dissociated the two conditions of heat and moisture, showing that

while in combination they could effect a transformation to the full wet-season form, the employment of the latter only without the former produced an entirely different result, the most distinctive mark of the new form being the accentuation of a feature usually characteristic of the dry season.

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Wednesday, March 20th, 1907.

Exhibition.

PARALLELISM BETWEEN THE GENERA PHRISSURA AND MYLOTHRIS.—Dr. F. A. DIXEY exhibited several species of *Phrissura* and *Mylothris* side by side, in order to illustrate the remarkable parallelism that exists between these two Pierine genera. The forms shown were as follows:—

Phrissura lasti, Grose Smith, ♂	*Mylothris narcissus*, Butl., ♂
P. sylvia, Fabr., ♂	*M. spica*, Mösch., ♂
P. sylvia, Fabr., ♀	*M. spica*, Mösch., ♀
P. sylvia, Fabr., ♂ (western form)	*M. bernice*, Hew., ♂
P. perlucens, Butl., ♂	*M. asphodelus*, Butl., ♂
P. phœbe, Butl., ♀	*M. poppea*, Cram., ♀
P. phœbe, Butl., ♀	*M. poppea*, Cram., ♂
P. phœbe, Butl., ♀	*M. rubricosta*, Mab., ♀

The genus *Phrissura*, he remarked, was closely akin to *Appias*, *Tachyris*, *Catophaga* and *Glutophrissa* ; *Mylothris*, on the other hand, occupied an isolated position and was of

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doubtful affinity. With the exception of two eastern forms, the species of *Phrissura*, like those of *Mylothris*, belonged to Africa. It was remarkable that there scarcely existed a single form of *Phrissura* that did not find a counterpart in the other genus, though there was nothing but a remote relationship between them. The forms that so closely resembled each other were, speaking generally, inhabitants of the same districts, and it was interesting to observe that where a species of the one genus underwent a local modification, the corresponding local race of the other genus was

similarly transformed in appearance. Thus the Uganda form of *P. sylvia*, ♂, closely resembled *M. spica*, ♂, from the same region, both being white butterflies with a dark apex to the fore-wing, a row of marginal black spots on the hind-wing, and a basal patch of bright orange. In the representative forms from the Congo region, *P. perlucens*, Butl., ♂, and *M. asphodelus*, Butl., ♂, the basal orange was in each case replaced by lemon yellow. Again, in the West African specimen shown of *P. sylvia*, ♂, the basal orange took on a darker tinge and was somewhat modified in shape, in both of which respects it came into close correspondence with *M. bernice* from the same locality. The facts might lend some apparent colour to the view that the correspondence was due in each case to similarity of surroundings. The speaker, however, thought that the difficulties in the way of such an explanation were insuperable, and that the relation was in every case mimetic. It would not be easy to say whether the mimicry was of the Batesian or of the Müllerian kind, the data being scarcely sufficient; he inclined personally to the belief that it would prove to be of the latter, *i. e.* the Müllerian sort, especially as there appeared to be indications of a diaposematic exchange of characters between the two series of forms.

He regretted that the Hope Collection possessed no specimens of *P. nyasana*, Butl., ♂, for this form together with *M. rüppellii*, Koch, ♂, would have made a striking addition to the exhibit. He should have preferred also to put a specimen of the West African *P. isokani*, Grose Smith, ♀, beside the *M. poppea*, ♀, from Ashanti, had one been available.

Though he had on the present occasion confined himself to

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the parallelism existing between these two genera, he wished also to remark that in many cases the actual forms shown formed part only of a much larger mimetic association.

Papers.

Among the papers communicated was :—

"Studies in the *Tetriginæ* (Orthoptera) in the Oxford Museum," by Joseph L. Hancock, M.D., F.E.S.

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Wednesday, April 10th, 1907.

Exhibitions.

Similarity between Dry-season Forms of allied Pierine Species.—Dr. F. A. Dixey exhibited male specimens of the wet- and dry-season phases of the following African and Indian *Pierinæ* :—

Teracolus achine, Cram.	*T. antigone*, Boisd.
T. omphale, Godt.	*Huphina nadina*, Luc.
T. evenina, Wallgrn.	*H. nerissa*, Fabr.

He remarked that the exhibit illustrated two points :—(1) the fact that in *Pierinæ* which were subject to seasonal
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dimorphism the dry-season form was often conspicuously smaller than its wet-season representative; and (2) the fact that the males of species which were easily discriminated in their wet-season phases might be almost indistinguishable from each other in the dry-season garb, the same applying, though less markedly, to the females. In the case of the four species of *Teracolus* shown, though there was a family likeness between all the wet-season forms, they could nevertheless be distinguished at a glance. On the other hand, the dry-season forms of the same four species resembled each other so closely in aspect, and even in size, that they could not be separated without minute examination. He knew from personal experience that these dry-season forms were most difficult to identify in the field. The two species of *Huphina*, again, bore in their dry-season phase a very close resemblance to each other, but in the wet-season they were quite dissimilar.

He did not advance either of these points as being of universal application; though the former of them, at least, was of very common occurrence.

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Wednesday, May 1st, 1907.

Divergent Mimicry by the Females of Leuceronia argia, Fabr.—Dr. F. A. Dixey exhibited specimens of *Leuceronia argia*, Fabr., ♂ and ♀, together with several

forms belonging to four other Pierine genera. He remarked on them as follows :—

"Mr. Trimen ('South African Butterflies,' vol. III, 1889, p. 181) has drawn attention to the resemblance borne to *Mylothris agathina*, Cram., and *Belenois ianthe*, Doubl., by certain forms of the female *Leuceronia argia*, Fabr. The female of this Pierine is extremely variable, and the object of the present exhibit is to show that each of its diverse forms is associated in aspect with one or more species of *Mylothris*, *Belenois*, *Pinacopteryx* or *Phrissura*—all these being genera whose affinity with *Leuceronia* is remote.

"The following are the forms now exhibited, together with the types which they respectively resemble :—

Form of *L. argia*, Fabr., ♀	Associated with
1. White, black-bordered form (= f. *typica*, Auriv.).	*Belenois theuszi*, Dewitz, ♂.
2. The same, with orange basal flush on forewings (=f. *poppea*, Donov., teste, Butler).	*Mylothris rüppellii*, Koch, ♂.
3. White, slight dark border, pinkish basal flush just showing through upper surface of forewings.	*Phrissura phœbe*, Butl., ♀.
4. White, border of conspicuous dark spots, orange-vermilion basal flush.	*Mylothris rüppellii*, Koch, ♀.
5. Yellow, strongly-marked dark border, orange basal flush (= f. *sulphurea*, Auriv.).	*Mylothris rüppellii*, Koch, ♂ (yellow form).
6. White, slightly-marked spotty border, yellowish hindwings, pale orange basal flush.	*Pinacopteryx rubrobasalis*, Lanz, ♀.
7. Ordinary Natal form (= f. *varia*, Trimen), showing under-side.	*Mylothris agathina*, Cram., ♂ (under-side).

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"These examples do not exhaust the list of forms of *L. argia*, ♀, which resemble other Pierine species; for besides the black and yellow f. *idotea*, Auriv., which is the form noticed by Trimen for its resemblance to *Belenois ianthe*, there is a modification of f. *varia*, Trim., with a yellowish hind-wing like No. 6 *supra* but without the basal flush, which falls into association with a form of the female *Pinacopteryx pigea*,

Boisd. Besides this, f. *semiflava*, Auriv., at once suggests membership of a numerous assemblage characterised by brown upper and pale under-wings, to which group also belong many females of *Mylothris spica*, Mösch., *Phrissura sylvia*, Fabr., *Belenois theuszi*, Dewitz, and *B. theora*, Doubl.

"The question naturally arises, what is the meaning of these resemblances? I am not credulous enough to believe that they represent a mere series of coincidences; it appears to me that they must have some bionomic significance, and that in the present as in similar instances the interpretation least attended with difficulty is that which attributes to them a mimetic value. It is generally admitted that *Mylothris*, forms of which so often take a central position in these supposed mimetic groups, is a well-protected genus. There is therefore good reason for its imitation by *L. argia*, whether this imitation be of the Batesian or of the Müllerian kind. It is true that *L. argia* is seldom a very perfect mimic; its various forms seem to hover on the outskirts of mimetic groups without entirely casting in their lot with them. But cases similar to this are known elsewhere; and much the same, *mutatis mutandis*, might be said of many instances (which few would be found to dispute) of protective resemblance to inanimate objects. We find, indeed, as under the theory of adaptation by selection we should expect to find, every sort of gradation between protection which is only slight, and protection which is all but complete; and this, whatever be the special kind of protection in question. If a species be maintaining its ground, deficiency in one particular will be made up for by excellence in another. xxxi]

"Some of the forms of *L. argia*, ♀, are restricted to definite regions, and it is natural to ask whether these mimics and their models are always to be found in the same locality. To a great extent this can be shown to be the case, but a wider knowledge than we at present possess of the distribution of both sets of forms would be necessary for a complete answer to the question. Meanwhile, the facts now at our command do not suggest an answer unfavourable to the theory.

"I have heard it remarked that whereas the form *sulphurea* of *L. argia*, ♀, has a well-marked dark margin, the *Mylothris*

with which it is here associated has no continuous dark marking, except at the apex of the fore-wing. Experience, however, leads me to think that although a border of black spots on a white or pale-coloured wing—the arrangement so commonly seen in *Mylothris* but obsolescent in this particular form—is a conspicuous feature, a uniform dark border (as in *Belenois severina*, Cram., ♀) is often unnoticeable during flight; the chief effect of such a border being to diminish the apparent size of its possessor, and sometimes (if the internal bounding line is irregular) to convey in addition the impression of a worn or ragged edge to the wings. There is reason therefore to suppose that the resemblance between these two forms is quite close enough to be effective.

" It may, in conclusion, be remarked that the present case is in some respects analogous with that of *Papilio dardanus*. In both we have a series of females, differing widely from the male and from each other, and each bearing a resemblance to a protected form belonging to another group. The differences in *L. argia*, though similar in kind, are far less striking in degree than those shown by *P. dardanus*; this corresponds with the greater family resemblance between the models of the *Leuceronia* as compared with those of the *Papilio*."

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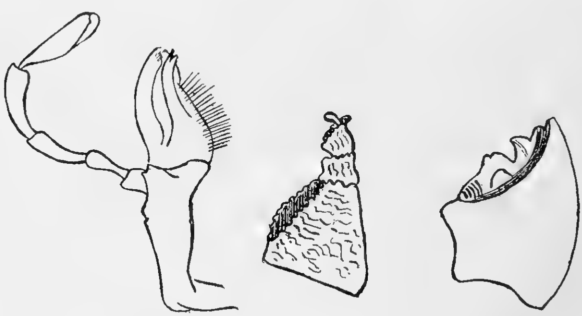
Mr. R. Shelford read the following note on

" A Case of Homœotic Variation in a Cockroach."

Homœosis has been defined as "the assumption by one member



Left maxilla. *Right maxilla.* *Right mandible.*

of a Meristic series, of the form or characters proper to other

members of the series" (Bateson, "Materials for the Study of Variation," London, 1894, p. 84). This type of abnormality is of rare occurrence; Mr. Bateson is only able to quote four examples of it amongst the Insecta, and two of these are doubtfully genuine. The undoubted cases are *Cimbex axillaris* and *Bombus variabilis*, both insects having the left antenna partially developed as a foot (*l.c.* pp. 146–148). I daresay that other cases of homœosis amongst insects have been recorded during the past twelve years, but if so, I have not

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come across any accounts of them. The abnormality now to be described seems to be of the nature of a homœotic variation. When dissecting a cockroach of the genus *Panesthia*, apparently a new species allied to *P. sinuata*, Sauss., I observed that the right maxilla was replaced by a hard chitinous structure superficially resembling a mandible; the left maxilla and both mandibles were perfectly normal. On removing and closely examining the right "maxilla" it was seen to be a densely chitinised and rugose organ, roughly approximating in shape and size to a normal mandible. This "maxilla" at the base is large, but it tapers distally and the apex bears a small finger-like process. Traces of segmentation are seen in two circular grooves and in the different size of the parts defined by these grooves; the organ may be regarded as made up of four segments, the terminal small process being one, but it is perfectly rigid and the segmentation is only visible on close examination. The basal segment is hollowed out on its inner face and it is this feature which increases the general resemblance of the structure to a mandible. Without going so far as to say that the abnormal "maxilla" of the cockroach under notice reproduces the ancestral condition of a mandible, attention may be drawn to the view that the mandibles are derived from a four-segmented organ, advocated by Wood-Mason and other entomologists. Wood-Mason moreover has observed that the mandibles of the embryo of *Panesthia javanica* are segmented, and in the larvæ and adults of the same species he distinguished a groove across the back of the mandible at the base, representing in his opinion the remains of a joint. The cockroach exhibiting the variation described

above was captured on Mt. Masarang in N. Celebes by Dr. Chas. Hose in 1895.

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Wednesday, June 5th, 1907.

The significance of some Secondary Sexual Characters in Butterflies.—Professor E. B. Poulton, F.R.S., said that he wished to bring before the Fellows a hypothesis which had suggested itself as the outcome of reflections upon the *Heliconinæ,* as dealt with by Mr. W. J. Kaye in a recent communication.

It had often been noticed that mimetic resemblance is apt to deceive the species concerned, so that the male of one will chase the female of the other. When model and mimic

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belong to very different groups, *e.g.* sub-families, it is improbable that such errors of judgment could lead to any important danger. It is very unlikely that a superficial resemblance would mislead the individuals of species belonging to different sub-families when they approached each other at all closely, and the impression made by each upon the whole of the sense-organs of the other became at all strong. But this would not apply to anything like the same extent when there was near relationship between the mimetic species—as in so many *Ithomiinæ, Danainæ,* and *Heliconinæ.* When close resemblance obtains within the limits of such a sub-family as one of these,—and mimetic likeness of the kind is often extraordinarily exact,—it is not a far-fetched hypothesis to suggest that some special adaptation has arisen, enabling the females easily to discriminate between their own and the males of other closely similar species, and at once to repel those advances which are something of a danger and nothing of advantage to either species. Other facts, and especially the hard, pouch-like structure secreted by the male upon the body of the female in *Parnassius* and in *Acræinæ,* also support the conclusion that useless pairing and attempts to pair are an injury to the species. Colour and pattern being excluded *ex hypothesi,* some special difference in scent is

the most obvious means of discrimination. May not this be the meaning of the fact that the males of the *Euplœini* may be divided into groups (which have been given generic names) distinguished, and sometimes solely distinguished, by remarkable differences in the size, number, form and position of the areas presumed to be scent-producing? These *Euplœas* are remarkable for the number of their synaposematic associations and for the closeness of the resemblance between the constituent species. So far as my experience goes,—and further inquiry in the same direction will tend to supply confirmation or refutation of the hypothesis here put forward—these associations are made up of species belonging to groups with different forms of sexual brands and not by species with males bearing the same type of brand. And now Mr. Kaye has shown that the close synaposematic pairs within the Heliconine sub-family are made up of species of which one belongs to the
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group with a broad the other to the group with a narrow band of glistening scales, in the male,—bands which are presumably scent-producing. It is probable that the excessively close resemblance between these pairs and between the members of the Euplœine associations has been rendered possible without injury to the species by the existence of this means of instant recognition, and I think it is possible to infer the past history with a fair degree of probability. In the African Danaine genus *Amauris* we find two very common species as closely alike as any of the Euplœine or Heliconine Müllerian groups or pairs. I refer to *Amauris echeria* and *A. albimaculata*. It was at first thought that white spots in place of buff in the fore-wing alone distinguished these forms, and the general opinion followed that one was a variety of the other. But Rothschild and Jordan have shown that they are certainly separated by minute but well-defined and constant differences. Accompanying these, the scent-patches at the anal angle of the hind-wing of the male of *albimaculata* are about twice as long as those of *echeria*. It is probable that this wide difference has been a powerful aid in rendering possible the extraordinarily close resemblance. Already both species of this pair have undergone subspecific changes in

different parts of their geographical range, the southern forms being replaced respectively by *echeria jacksoni* and *albimaculata hanningtoni* in the equatorial parts of the eastern side of Africa. In the Oriental Region the even more dominant Euplœine group originated far more complex communities, probably in consequence of the development of further modifications of the male brands of one or both members of an ancestral pair, until synaposematic associations containing 3, 4 or more species arose, widened their range and spread into islands. Thus each of the component species became at first different sub-species and finally distinct species in various parts of the total area of distribution. The synaposematic Heliconine pairs, on the other hand, may in large part have reached their present condition by continuing the history begun by the two African species of *Amauris*. I say "in large part" because when Mr. Kaye very kindly arranged the Oxford *Heliconinæ* a few weeks ago we saw evidence for [xliii

the *recent* abandonment of relatively ancestral patterns by certain species and the adoption of others which brought them into synaposematic relation with some more abundant Heliconine in the same locality. In giving this brief account of the hypothesis I am quite aware that the subject requires much fuller study. At the same time, I think it better not to wait for the more detailed examination which I hope to make, but to put the suggestion on record, in the hope that others may be led to further observation and reflection on the subject. [xlvii

Papers, etc.

Dr. F. A. Dixey, M.A., M.D., and Dr. G. B. Longstaff, M.D., contributed a report of their joint entomological observations made in South Africa during the visit of the British Association in 1905, and gave a brief account of some of the points dealt with.

Dr. Dixey said that his own part in the paper was small, though Dr. Longstaff had kindly wished to associate him in the authorship. The narrative was the work of Dr. Longstaff, aided by a few suggestions from himself, and that gentleman had also undertaken most of the labour connected with the

determination of species, especially in Orders other than Lepidoptera. Dr. Longstaff's contribution to the tale of specimens brought home was also far larger than his own. He had himself devoted more attention to bionomic points than to the actual work of collecting, and many of the results of the observations of himself and his colleague had been already communicated to the Society.

After shortly sketching the route of the expedition, which included visits to Cape Town, Port Elizabeth, East London,
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Durban, Ladysmith, Johannesburg, Pretoria, Bloemfontein, Kimberley, Mafeking, Bulawayo, the Matoppos, and the Victoria Falls, he remarked that among the things that chiefly impressed him were the abundance of insect life at East London and Durban, and the extremely interesting, though in their experience somewhat scanty, fauna of the Zambesi and the Great Waterfall.

A point that seemed to him worthy of notice was the fact that although Dr. Longstaff and himself were close travelling companions, and on many days were never more than half-a-mile from each other, the captures effected by each showed remarkable differences, there being several instances of quite conspicuous forms taken by one which were never seen by the other. This was no doubt partly due to differences in their objects and methods of collecting, but it applied also to species that both collectors were desirous of taking.

Dr. G. B. LONGSTAFF stated that out of eight weeks in South Africa, two had been spent in railway trains, nevertheless they had taken some 2,500 specimens, including upwards of 50 species of various Orders not to be found in the National Collection; of these at least 15 had already been recognised as new to science. In exhibiting specimens of the new species together with other South African insects remarkable in one way or another, Dr. LONGSTAFF gave some account of interesting points in their bionomics. For example, at Simon's Bay, a fly, *Ploas* sp., during life by its habits and mode of flight closely mimicked the bee *Halictus albifasciatus*, Smith, although the insect looked very different in the cabinet. The large Acridian, *Phymateus leprosus*, Serv., unlike most locusts, was extremely

sluggish in its movements, but was defended in part by its hard integuments, but probably still better by emitting copiously when touched an ill-smelling acrid fluid. A new *Flata*, taken at Johannesburg, though found sitting in rows upon the stems of plants, could in no sense be said to resemble flowers, as was the case with some of its congeners.

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Wednesday, October 2nd, 1907.

Exhibitions.

SITARIS MURALIS AT OXFORD.—Commander J. J. WALKER showed living specimens of the Heteromerous beetle *Sitaris muralis*, rediscovered at Oxford in 1903 by Mr. A. H. Hamm of the Oxford University Museum, and found rather freely during September 1906 and 1907, on old stone walls in the vicinity of Oxford inhabited by the Mason Bee, *Podalirius* (*Anthophora*) *pilipes*, on which it is parasitic in its early stages.

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TRANSITION BETWEEN MYLOTHRIS CHLORIS, FABR., AND M. AGATHINA, CRAM.—Dr. F. A. DIXEY exhibited typical specimens of the African Pierines *Mylothris chloris*, Fabr., and *M. agathina*, Cram.; together with a long series of forms, transitional between the two, from the neighbourhood of the Victoria Nyanza.

He remarked that he had previously called attention to the fact that the West-African *M. chloris* and the East- and South-African *M. agathina*, which had always been looked upon as distinct species, intergraded with one another in the region of

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Uganda (Proc. Ent. Soc. Lond., 1904, p. xv). The present exhibit showed an uninterrupted transition, in the case of the males, from one form to the other. The females passed by almost imperceptible gradations from the brownish-orange *M. agathina*, with its marginal row of well-defined black spots, up to a form with whitish fore-wings and very pale ochreous hind-wings broadly margined in black, between which latter

form and the ordinary female of *M. chloris* there was only a slight interval. It was true that his present material did not enable him to bridge over the gap; but in view of the near approach to the typical *M. chloris* exhibited by these intermediate females, and of the complete transition which he had shown to exist in the case of the males, he thought it could hardly be doubted that further investigation would supply the very few steps still lacking. A transitional female from Wadelai, of the kind he had described, had been named *clarissa* by Butler.

The greater number of the 31 specimens now shown were collected by Mr. Wiggins on the north-east and north-west shore of the Victoria Nyanza; two of his males were from Toro in Western Uganda, and one interesting female specimen, showing an early stage of departure from *M. agathina* in the direction of *M. chloris*, was captured at Mombasa. The fact that the forms referred to occurred together was established by a remarkable series of six specimens all taken on the same day by Mrs. Leaky near Mengo, on the north-west shore of Victoria Lake. This series consisted of a typical male and female *M. chloris*, and a nearly typical male *M. agathina*; together with a transitional male and two transitional females, the latter closely resembling the type of Butler's *M. clarissa*.

Mr. Neave had shown, from Uganda specimens also collected by Mr. Wiggins, that a similar transition occurred in that region between the western *Amauris niavius*, Linn., and the eastern and southern *A. dominicanus*, Trim. (Proc. Ent. Soc. Lond., 1903, p. xciv; Trans. Ent. Soc. Lond., 1906, p. 211).

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Wednesday, November 6th, 1907.

New Species of Pinacopteryx.—Dr. F. A. Dixey exhibited ♂ and ♀ specimens of a *Pinacopteryx*, at present undescribed, which had been discovered by Mr. S. A. Neave in North-East Rhodesia.

He remarked that the interesting genus *Pinacopteryx*, which was purely African in distribution, formed a very natural group amongst Pierine genera, somewhat isolated in affinity,

but on the whole perhaps coming nearest to *Belenois*. Many members of the genus had been affected by mimicry, and one species, *P. rubrobasalis*, Lanz., was an excellent copy in both sexes of the familiar *Mylothris agathina*, Cram. This was also [lxvi the case with the females of the new species, which Mr. Neave said he had often mistaken for *M. agathina* when on the wing. On the other hand, the males were quite different, showing no trace of resemblance to that species of *Mylothris*. When the speaker first looked through Mr. Neave's captures, he was inclined to conjecture that these females were the local representatives of *P. rubrobasalis*, ♀, which they closely resembled, and that their captor had failed to meet with the corresponding males. But he found that Mr. Neave had assigned them without hesitation to males of an aspect entirely different from that of *P. rubrobasalis* and *M. agathina*, and that in one instance at least this opinion had been confirmed by the capture of paired specimens. On further examination there appeared to be no doubt that the resemblance between the females of the two species was due rather to the copying of a common model than to mere affinity, and that Mr. Neave's species and *P. rubrobasalis* belonged in reality to distinct sections of the genus. Specimens of *Mylothris agathina*, the common model, were included in the exhibit; also males and females of *P. rubrobasalis* and other members of the genus, together with individuals of the new species which were actually paired at the time of capture.

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Papers.

Dr. G. B. Longstaff, M.D., read a paper "On some Butterflies taken in Jamaica," and a paper "On some Butterflies of Tobago," exhibiting a number of examples taken by himself in both localities to illustrate his remarks.

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Wednesday, November 20th, 1907.

Mimetic Parallelism in Five Genera of African Pierines.—Dr. F. A. Dixey exhibited series of specimens belonging to five different genera of African *Pierinæ*. He remarked that

the exhibit was arranged so as to show the parallelism existing between many species of these genera, a parallelism which it could hardly be doubted was in most, if not in all cases, of mimetic significance. The genera included in the exhibit were *Mylothris*, *Phrissura*, *Pinacopteryx*, *Belenois* and *Leuceronia*. The members of the same genus were arranged in vertical rows, while the species of different genera showing a similar appearance were set out side by side, horizontally. The various assemblages, each presenting a distinct pattern, with their constituent species, were as follows:—

I. White with dark marginal spots. *Mylothris agathina*, Cram., ♂; *Pinacopteryx rubrobasalis*, Lanz., ♂; *Belenois thysa*, Hopff. ♂; *Leuceronia argia*, Fabr., ♀.

II. Brownish-yellow with dark marginal spots. *M. agathina*, ♀; *Pinacopteryx vidua*, Butl., ♀; *B. thysa*, ♀ (dry season). Some specimens of *Pinacopteryx astarte*, Butl., ♀; of *Belenois theora*, Doubl., ♀; and also a form of *L. argia*, ♀, belong to this group, but were not shown.

III. White with dark apical patch and dark marginal spots. *Phrissura phaola*, Doubl., ♂; *Pinacopteryx dixeyi*, Neave, ♂; *Belenois theuszi*, Dewitz, ♂; *L. argia*, ♂.

IV. The same, with a slight brownish-yellow basal suffusion. *M. poppea*, Cram., ♂; *P. dixeyi*, ♀; *Belenois ianthe*, Doubl., ♀; *Leuceronia thalassina*, Boisd., ♀.

V. White; marginal dark spots tending to become streaks; an orange or pinkish basal flush. *M. poppea*, ♀; *Phrissura isokani*, Gr. Smith, ♀ (= *P. phœbe*, Butl.); *B. ianthe*, ♀; *Belenois sp.* (allied to *B. thysa*), ♀; *L. argia*, ♀.

VI. Fore-wings brownish-yellow with dark margins; hind-wings white or creamy with dark marginal spots. *Mylothris spica*, Mösch., ♀; *Phrissura sylvia*, Fabr., ♀; *L. thalassina*, ♀.

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Specimens of *B. theuszi*, ♀; of *B. theora*, Doubl., ♀; and of *L. argia*, ♀ (form *semiflava*, Auriv.) also come into this group, but were not included in the exhibit.

VII. Bright yellow with dark marginal spots or (on fore-wings) an irregular marginal band; fore-wings with orange basal flush. *Mylothris rüppellii*, Koch, ♂ (yellow form); *L. argia*, ♀ (form *sulphurea*, Auriv.).

VIII. White with dark marginal spots; fore-wings with large basal orange-vermilion flush. *M. rüppellii*, ♂ (upper- and under-side); *L. argia*, ♀ (form *varia*, Trim.). *Phrissura nyasana*, Butl., ♂, is also a member of this group.

IX. White with dark marginal spots; a small patch of orange at base of fore-wings, and the same colour prolonged on costa of hind-wings. *M. spica*, ♂; *P. sylvia*, ♂; *P. dixeyi*, ♂; *B. theuszi*, ♂ (all under-sides).

X. White; fore-wing with dark margin broadened at apex, hind-wing with dark marginal spots. *M. spica*, ♂; *P. sylvia*, ♂; *L. argia*, ♀ (form *poppæa*, Donov.).

XI. Like IX and X, but orange of IX replaced by lemon-yellow. *Mylothris asphodelus*, Butl., ♂; *Phrissura perluceus*, Butl., ♂; *B. theuszi*, ♂ (under-side). All these specimens are from the Congo.

XII. Fore-wings whitish with a pale orange basal flush; hind-wings orange-yellow; both wings with a border of dark spots. *Mylothris clarissa*, Butl., ♀; *Pinacopteryx sp.* (allied to *P. orbona*, Hübn.), ♀; *B. thysa*, ♀ (intermediate form).

XIII. Like XII, but with the hind-wings a paler yellow, and the marginal spots tending to become streaks. *P. isokani*, ♀ (= *P. phœbe*); *Pinacopteryx sp.* (allied to *P. orbona*), ♀; *L. argia*, ♀.

XIV. Fore-wings white with brilliant orange-vermilion basal flush; hind-wings ochre-yellow; dark marginal spots. *M. agathina*, ♂; *P. isokani* (*phœbe*), ♀; *P. rubrobasalis*, ♀; *B. thysa*, ♂; *L. argia*, ♀ (all under-sides).

XV. Fore-wings white; hind-wings lemon or primrose-yellow; dark marginal spots more or less developed, and on fore-wing sometimes fused. *Mylothris trimenia*, Butl., ♂; *M. narcissus*, Butl., ♀; *M. jacksoni*, E. M. Sharpe, ♀; *Phrissura*

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lasti, Gr. Smith, ♂; *Pinacopteryx sp.* (allied to *P. vidua*, Butl.), ♀; *Belenois sp.* (allied to *B. zochalia*, Boisd.), ♀.

XVI. Like XV, but with hind-wings ochreous or brownish-yellow. *M. trimenia*, ♀; *P. lasti*, ♀; *P. pigea*, Boisd., ♀; *Belenois sp.* (allied to *B. zochalia*), ♀; *B. zochalia*, ♀; *L. thalassina*, ♀.

Dr. Dixey further remarked that though attention had already been drawn to several of these cases of resemblance by Mr. Trimen, Prof. Poulton, Mr. Neave and others, as well as by himself, they had not before been shown together in one view. In some instances the superficial resemblances between insects of very different genera belonging to this series had led to much confusion in the nomenclature, for an example of which he would refer to the facts given in Mr. Trimen's "South African Butterflies," Vol. iii, 1889, p. 35 and note. The five genera now shown, though all belonging to the *Pierinæ*, were not closely related; *Pinacopteryx* and *Belenois* probably stood nearest to one another in point of affinity, but were still abundantly distinct. *Mylothris* occupied an isolated position, while *Phrissura* was allied to the Eastern genera *Tachyris*, *Catophaga* and *Appias*. *Leuceronia* was widely removed from all the rest. Hence there was little or nothing to support the suggestion that these likenesses might be merely the consequence of affinity.

It was worthy of note that some form of the genus *Mylothris* was usually to be found at the centre, so to speak, of each of these different colour-assemblages. But this was not invariably the case, and it not infrequently happened that the species of other genera showed a closer resemblance to each other than either of them did to the *Mylothris*. This was perhaps especially the case as between the two genera *Belenois* and *Pinacopteryx*, but striking instances also occurred between *Phrissura phaola* ♂ and *Belenois theuszi* ♂, and between *Phrissura isokani* ♀ and the female of a *Belenois* allied to *B. thysa*. It was a further point of interest that the streaky character of the dark margin of the wings, well seen in *M. poppea*, ♀, appeared to have originated not in that genus, but in the genera *Phrissura* and *Belenois*. Its adoption by *Mylothris*, which was on all hands admitted to be a distasteful genus,

seemed to favour the supposition of a Müllerian element in this series of resemblances, which interpretation was also suggested by the cases of "secondary mimicry" already referred to. The striking aposeme, peculiar to African butterflies, constituted by dark marginal spots on a pale

ground, was a predominant feature of the whole series, and, though especially characteristic of *Mylothris*, appeared in some instances to exist independently of that genus. Another prevalent aposeme was the orange or scarlet basal flush well seen in *Mylothris rüppellii*. It was significant that both these warning marks tended to be better developed on the under-surface.

Dr. DIXEY concluded by drawing attention to the fact that these colour-assemblages were by no means isolated clusters. On the contrary, they passed into one another in many directions, though this was not easily observed in an exhibit arranged like the present. As a matter of fact, the whole array of specimens shown might be regarded as forming a net-work, each individual being connected with all the rest by a larger or smaller number of gradations. It would be seen on tracing out these lines of connection that they ran to a very large extent independently of affinity. The phenomena were indeed in many respects comparable with the facts regarding mimicry in the Neotropical region, to which he had drawn attention in "Nature" for October 31, 1907, pp. 677–8.

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ASSOCIATION OF ALLIED FORMS OF SOUTH AMERICAN BUTTERFLIES.—Dr. G. B. LONGSTAFF exhibited a case containing 35 Ithomiine butterflies of 11 species, belonging to 6 genera, all taken in a little over an hour, on March 20th, 1907, at about 4.0 p.m. near Carácas, Venezuela, some 3600 feet above sea-level. They were disturbed in a shaded gorge and all taken on a piece of moist ground measuring perhaps 60 yards by 10 yards. They were all flying together like a cloud of gnats and many more might have been secured, but the number of distinct species was not recognized at the time. This habit of butterflies of this group thus congregating together was described by Bates.* It affords a striking exception to Darwin's principle that closely allied forms are

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not usually found together. When on the wing out of the sun the clear-winged species were difficult to see, only the white or yellow markings catching the eye, but in the

* Trans. Linn. Soc. 1862, pp. 539, 541.

sunshine the clear parts of the wings sometimes gave an iridescent gleam.

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Papers.

In illustration of his paper " Mimicry in North American Butterflies of the genus *Limenitis* (*Basilarchia*)," Professor E. B. Poulton, F.R.S., showed specimens of *Adelpha* (*Heterochroa*) *bredowi*, ranging from Guatemala to Arizona, and its northern form, named *californica* by A. G. Butler, from California and Oregon. With these he exhibited specimens of *Limenitis* (*Basilarchia*) *lorquini*, Boisd., taken together with the *Adelphas*, by Mr. F. D. Godman, F.R.S., in the two last-named States. A specimen of *lorquini* from Esquimalt, Vancouver's Island, was also exhibited for the purpose of comparison with the southern individuals. Professor Poulton pointed out that *lorquini* resembles the *Adelpha* and differs from its ancestor *L.* (*B.*) *wiedemeyeri*, Edwards, in the cream colour of the band which crosses both wings and the presence of a brown apical patch on the fore-wing. The specimen from Vancouver's Island far north of the range of the *Adelpha* showed a great reduction in the size of the apical patch. The *californica* form of the *Adelpha* furthermore differed from the southern *bredowi* form and resembled the *L.* (*B.*) *lorquini* in the reduction of the brown mark at the anal angle of the hind-wing, in the more broken and irregular appearance of the cream-coloured band, and markedly in the broader, shorter shape of the wings. These mutual resemblances appeared to offer a striking example of Dr. F. A. Dixey's principle of Reciprocal Mimicry (Diaposematic Resemblance). Professor Poulton said that he was indebted to the kindness of Mr. F. D. Godman for the opportunity of showing the specimens to the Society.

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Wednesday, December 4th, 1907.

Reciprocal Convergence in Limenitis.—Professor Poulton exhibited 7 males and 4 females of *Limenitis* (*Basilarchia*) *lorquini* from Vancouver's Island; 11 males and 1 female

from British Columbia; 4 males from California; also 4 examples of the Californian form of *Adelpha bredowi*, together with 5 specimens of the same species from Mexico and 1 from Guatemala. He also exhibited 2 males of the species which probably represents the ancestor of *lorquini*, viz. *Limenitis* [lxxx (*Basilarchia*) *wiedemeyeri*, from Colorado. This much larger series supported the conclusions suggested by the smaller exhibit shown by Professor Poulton at the previous meeting:—viz. that the superficial appearance of *A. bredowi* and of *L.* (*B.*) *lorquini* undergoes reciprocal convergence in the areas where these two species fly together, but that where each of them exists alone, *lorquini* to the W. and *bredowi* to the S., the resemblance to the other is much reduced.

New Species of Belenois.—Dr. F. A. Dixey exhibited male and female specimens of a new *Belenois* allied to *B. zochalia*, Boisd., but quite distinct from the *zochalia* group. These were captured by Mr. Wiggins in the Tiriki Hills, north-east of the Victoria Nyanza.

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Papers, etc.

Professor E. B. Poulton, F.R.S., communicated the following observations on the

Insect and other Foods of Blackgame

contained in a letter received from Dr. F. Menteith Ogilvie. His correspondent stated that the larvæ of *Bombyx rubi* had been unusually abundant on the Argyllshire moors during October (Dr. Ogilvie's visit had been from the 16th to the 28th of the month). The following extract from the letter indicates both the excessive abundance and the special protection of these larvæ:—"Had I set about seriously collecting them, I dare say I could have gathered over 1,000 of these caterpillars in a day. We shot a number of blackgame, grouse, and ptarmigan, and I examined the crops of a good many of these, more especially of the blackgame. The latter species we found out on the open moor—very few were in the woods and birch patches at this season—they therefore had ample opportunities of feeding on these hairy caterpillars had they been so minded.

But in the examination of the contents of the crops of a considerable number of birds of this species I never found one hairy caterpillar, though I often found one or two smooth-skinned caterpillars of different kinds. From this I came to the conclusion that these hairy caterpillars are noxious to birds—at any rate to the game birds I was dealing with—and that they are severely left alone."

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A later communication from Dr. Menteith Ogilvie contained the following interesting details :—"I enclose a rough note on the contents of the crops of five blackgame. I could send others, but the general result was the same in all the birds shot."

Blackgame, *Tetrao tetrix*, L. Contents of crop (5 specimens).
Barcaldine, Argyllshire.

1. ♀ Shot 17th October, 1907 (3 p.m.); crop fairly distended. "An immense number" of galls from oak trees, vulgarly "spangle galls" (*Neuroterus lenticularis*), probably not less than 500 of these.
   Also "an immense number" of small dark-brown beetles, *Lochmæa* (*Adimonia*) *suturalis* of Thomson, one of the plant-feeding section of the Coleoptera.
   A quantity of plantain leaves, others that appeared to belong to some kind of mint, and only one small flowering head of heather.
2. ♂ Shot 19th October, 1907 (4 p.m.); crop full.
   Plantain leaves, fully $\frac{1}{3}$ of the contents.
   Heather shoots, about another $\frac{1}{3}$.
   A few blaeberry tops (*Vaccinium myrtillus*).
   Marsh Trifolium (2 or 3 leaves); a fern leaf (? *Polypodium alpestre*).
   Many dark-brown beetles, as in ♀ of 17th October, 1907, but less numerous.
   One large smooth-skinned caterpillar, $1\frac{1}{4}$ in. long, 3 longitudinal yellow stripes on a dark olive-brown ground.
3 ♂ young. Shot 19th October, 1907 (10 a.m.); crop nearly empty.
   Seven berries of the mountain ash (Rowan), and

A few crinkly leaves, somewhat like parsley. (Sp. ?)

4. ♂ adult. Shot 18th October, 1907 (4 p.m.); crop very distended.

Large quantities of heather shoots.

Willow leaves. (Sp. ?)

[This is a dwarf willow which grows plentifully on the moors. I don't know the species—it is locally known as the "saugh" willow.]

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Flowering heads of a scabious.

Numerous fronds of a fern (? *Polypodium alpestre*), Tormentilla (*T. officinalis*), and two or three Trifolium leaves.

"Vast number" of spangle galls.

300 or more dark-brown beetles (*L. suturalis*).

One earwig, and

One large ($1\frac{1}{2}$ in. long) smooth-skinned green caterpillar.

5. ♀ Shot 18th October, 1907 (3 p.m.); crop half full.

Mainly heather shoots, with a good sprinkling of blaeberry (*V. myrtillus*).

Fern fronds (*P. alpestre*), a few.

"Immense number" of the usual small dark-brown beetle, and quantity of "spangle galls."

"The two outstanding features are the spangle galls and the small beetle. Almost all the birds were crowded with these, and, judging by my specimens, the blackgame must have been destroying enormous numbers of both. I don't think, as regards the beetles, it is any exaggeration to allow 300 beetles per day per bird. Ours is not a very good blackgame ground now, and perhaps we have 300 head in all; that would equal 90,000 beetles per day! I was surprised to find, too, how little heather was eaten in most cases, despite the fact that the birds were in almost every case found on the moor and not in the woods.

"The beetles were kindly identified for me by Commander Walker, and the oak spangles by the authorities at Kew."

Professor Poulton said that Dr. Menteith Ogilvie had kindly obtained specimens of the abundant hairy larvæ un-

touched by the birds, and that they were undoubtedly *Bombyx rubi.* He remarked upon the interesting fact that the beetle *Lochmæa suturalis,* so plentifully devoured by the blackgame, belonged to the *Galerucidæ,* a family generally believed to be distasteful, and certainly providing many models for mimicry. These particular Galerucids, however (examples of which were exhibited), were rather inconspicuous dark brown insects.

REST ATTITUDE OF HYRIA AURORARIA.—Mr. J. C. MOULTON read the following note:—"During the past summer I had the

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opportunity of studying the habits of this species in the field near Glastonbury, Somersetshire. I first met with it on July 2nd, and after a rainy interval saw it again on July 10th, 11th, and 12th. The moth frequented a small patch of ground about 80 yards square, covered with heath and ling, intermingled with bog-myrtle, alder bushes, and birch trees. The insect was on the wing in bright sunlight from 10.30 a.m. to 1.30 p.m. The rest attitude was first observed on July 10th; when following a moth that was flying about four or five feet from the ground, I saw it settle upon the ling a little ahead of me when it became invisible. However, on closer inspection I found it had alighted on a thin stem of ling, with the underside of its outspread wings uppermost. When disturbed it again took a short flight of a few yards, and settled in exactly the same manner. This happened during four successive flights of this one insect; and for the rest of that morning and the following days I was interested to notice that all the others, which I saw settle, invariably did so in this attitude. The interpretation is not far to seek when a comparison is made between the colouring of the upper- and under-sides. In the former the bright purple and rich golden markings at once attract the eye and render this little Geometer a conspicuous object. The under-surface, on the other hand, possesses a perfect cryptic colouring of dark dull purple, combined with shades of tawny yellow. It should be noted that on no occasion was the flower itself selected as a resting-place, but always the leaf or stem, the dull colour of which, combined with the dark shadows in the interior of the plant, formed a background harmonising in a remarkable manner with the exposed surface

of the insect. In conclusion, I should like to record my sincere gratitude to Professor Poulton for very kindly looking over this note."

Mr. R. Shelford, M.A., C.M.Z.S., F.L.S., read a paper entitled "Studies on the *Blattidæ*."

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The Rev. K. St. A. Rogers, introduced by Professor E. B. Poulton, F.R.S., read a paper entitled "Notes on the Bionomics of British East African Butterflies," and exhibited many examples collected by him, and from the Hope Museum, Oxford, to illustrate his remarks.

Richard Clay & Sons, Limited, London and Bungay.

Report of the Hope Professor of Zoology, 1906.

Great progress has been made in cataloguing and incorporating arrears, as well as the large number of accessions in the year under review. Full details will be found in the later pages of this Report. The additions to the Hope Library will be found to be far more considerable than in any previous year. The published memoirs which have issued from the Department or have dealt with its material are also more numerous than on previous occasions.

1. *Manuscript and other Records of William John Burchell.*

In the early summer of 1906, a large box of manuscript, &c., was most kindly sent to the Professor by Mr. Francis A. Burchell, of the Rhodes University College, Grahamstown, a grand-nephew of the great explorer and naturalist. The study of these invaluable records throws much light on the life of Dr. Burchell, and some of the chief results are briefly indicated in the form of foot-notes to the memoir in the *Report of the British and South African Associations*, 1905, vol. iii, pp. 57–110. Mr. F. A. Burchell has now most generously presented the whole of this material, with the exception of the originals of the letters and a single drawing, to the University. At a somewhat later date it is intended to publish in the GAZETTE a complete list of these priceless records.

2. *The Bequest of the J. C. Dale Collection.*

The bequest of this great and historic collection of British Insects is one of the most important accessions of recent years. It was bequeathed by the late Mr. C. W. Dale, formerly of Wadham College, a son of the distinguished entomologist, J. C. Dale. Mr. C. W. Dale had been a great friend of the late Professor Westwood, and had signified to the present Professor his desire to bequeath this great collection to the University. The extent of the bequest may be inferred from the following condensed statement of its contents:—

British Lepidoptera,	contained in	141	drawers in	7	cabinets.
Foreign	,,	,,	94	,,	3	,,
British Coleoptera		,,	107	,,	5	,,
,, Hymenoptera, Diptera, &c.		,,	175	,,	14	,,
Odonata (Dragon-flies)		,,	42	,,	4	,,
Shells, eggs, &c.		,,	7 or 8 cabinets.			

Messrs. Ffooks and Douglas, solicitors, of Sherborne, who had informed the Delegates of the bequest, were extremely kind in recommending a suitable carrier, and in urging the utmost care in moving the cases. The most interesting specimens are of great age and very fragile,—one butterfly is said to have been caught near Cambridge over 200 years ago,—so that the removal was a matter for considerable anxiety. The whole collection, carefully packed in a large spring van, was drawn slowly by road by a small traction-engine, and arrived in the most perfect condition. Accompanying the collection are several manuscript note-books referring to its specimens, and also a large number of letters from eminent students of the Insecta. The necessities of space prevent any further description of this most interesting and valuable collection. It is hoped that a full account of the features of chief interest will appear from time to time in the *Entomologist's Monthly Magazine*. Commander J. J. Walker, Hon. M.A., is at present engaged upon the Lepidoptera.

3. *Financial Gifts and Grants to the Department.*

The Common University Fund granted the sum of £100 in 1906, 1907, and 1908 for the purchase of cabinets. This valuable help will nearly complete the payment for two sets of ten cabinets, containing between them 400 drawers of the standard size and interchangeable. One of these sets has been ordered, and is now being made. This space will become available for the two groups of butterflies which alone await final arrangement, the *Papilioninae* ("Swallow-tails") and *Hesperidae* ("Skippers").

The opportunity was also afforded of purchasing the late Mr. Alexander Fry's cabinets, containing nearly 400 deep drawers of uniform size. These cabinets, with the drawers recorked, repapered and repaired, were bought for £163 1*s*. 5*d*., towards which the Delegates of the Museum contributed £50, the Professor £100. The space will be available either for part of the collection of moths or certain groups of Coleoptera.

The 530 drawers purchased from Mr. W. Schaus in 1905 are being gradually filled with the collection of Orthoptera, thus liberating a few of the fine old Standish cabinets for Diptera, Hymenoptera and Rhynchota.

In addition to the grant for cabinets the Delegates of the Museum contributed a sum of £24 15*s*. to defray the cost of carriage by road of the Fry cabinets from London and the J. C. Dale Collection from Glanvilles, Wootton.

The two years for which Dr. G. B. Longstaff kindly defrayed the expense of an extra assistant came to an end at the close of 1906, but the generous donor has renewed this valuable grant for the present year.

4. *Work done by the Staff.*

Mr. Shelford's work on the Orthoptera is described in the following section.

One of the most considerable pieces of work undertaken in 1906, and extending over into the early part of the present year, has been the sorting into groups, selection, cataloguing and incorporation of the vast collection of Bornean insects of

many Orders presented by Mr. Shelford in 1899–1901. The great majority having been given in 1900, all have been catalogued under that year, and a statement of numbers in the various groups will be found in the later pages of this Report. The work involved in making this extremely fine gift available has chiefly fallen upon Mr. Holland, although a large part has also been undertaken by Mr. Collins. The specimens had been pinned and labels printed and affixed in previous years.

The whole of the *Geometrae*, of which the South American species had been finished in 1905, have now been safely arranged by Mr. Holland in about 60 cabinet drawers, in place of the dangerous store-boxes in which they had been previously contained. The rearrangement of the *Acracinae* was begun, and has been since completed. Furthermore, a great deal of Mr. Holland's time was occupied by the readjustment of the *Danainae* and *Nymphalinae*, rendered necessary by the large number of accessions in these subfamilies of butterflies, and in relabelling the outsides of the drawers.

Perhaps the largest single piece of work undertaken by Mr. Holland during the year has been in connexion with the very fine collection of nearly 7,000 British Micro-Lepidoptera presented by Mrs. E. C. Bazett, of Reading, in 1905. The whole of these have been staged, and the data copied and classified ready for printing the labels. In addition to the above, Mr. Holland has continually been called away from other work in order to incorporate the numerous and varied accessions acknowledged at the end of this Report.

A considerable amount of setting and pinning has been entrusted, as in former years, to the care and skill of Mr. A. Cant. The remainder—including large collections presented by Mr. Guy A. K. Marshall, Mr. J. C. Kershaw, Mr. S. A. Neave, in conjunction with the British South African Company, and the Tring Zoological Museum, as well as the large collections brought from South Africa in 1905 by Dr. G. B. Longstaff, Dr. F. A. Dixey, and the Professor—has occupied the principal part of Mr. A. H. Hamm's time. He

has also repinned, and when necessary reset, part of the old collection—the *Blattidae* among the Orthoptera and the *Thynnidae* among the Aculeate Hymenoptera. A great deal of time was also expended upon the setting and labelling of the material, especially the *Asilidae* and the *Empidae*, for the Professor's memoir on Predaceous Insects. Mr. Hamm has also arranged the examples of captors and their prey in such a manner as to illustrate the paper. He was also much occupied in printing labels for many groups of the recent accessions.

The long list of catalogued accessions at the end of this Report indicates the amount and kind of work which has occupied almost the whole of Mr. J. Collins's time. Probably the chief labour was that involved in printing the names and data for Colonel Yerbury's splendid donation to the collection of British flies; and in printing the data for Mr. H. St. John K. Donisthorpe's fine gift of British Coleoptera. A large amount of work was also expended upon the Rev. K. St. Aubyn Rogers's donation of British East African butterflies, which were "set" in London. In addition to this kind of work, the extent of which can be estimated by a study of the additions to the collections, Mr. Collins and Mr. Hamm repapered a number of the old cabinet drawers, Mr. Collins renewed the spirit in the parts of the collection thus preserved, carefully arranged for exhibition in the corridor two sets of butterflies from the Potaro River, and gave much help to Commander Walker in preparing the British Collection of Coleoptera for rearrangement.

5. *Work on the Collections of Orthoptera.*

The following report has been written by Mr. R. Shelford, M.A.:—

Work has been continued on the arrangement of the *Blattidae*, and the collection now includes 730 species, of which nearly 500 have been determined and described; 133 specimens are types. Three memoirs on the group have

been published in the Transactions of the Entomological Society of London and in the Annals and Magazine of Natural History, and the first part of a revision and enumeration of the genera is now in the press (Genera Insectorum). The small collection of *Blattidae* belonging to the Paris Museum of Natural History, and entrusted to me for determination, has been completely worked out, and there is now in my hands for description a large collection of *Blattidae* made by Dr. Yngve Sjöstedt of Stockholn, in the Kilimanjaro district of East Africa; duplicates from these collections will eventually be presented to the Hope Museum. The additions to the collection during 1906, though not very numerous, were of the greatest interest, since the specimens in most cases were accompanied by excellent data.

The *Mantidae* have been brought together from different sources and arranged; they now occupy 100 cabinet drawers and number 2.359 specimens, referred to 133 genera and 418 species, 212 of which are identified; the number of type specimens is considerable (65), the late Professor Westwood having devoted special attention to the group.

Of the *Acridiidae* the following sub-families have been arranged:—the *Eumastacinae*, numbering 170 specimens, belonging to 14 genera and 45 species; the collection includes 9 of the types of the species described by Mr. Malcolm Burr in his monograph of the group and 2 of Westwood's types. The *Proscopinae*, numbering 100 specimens (of which 2 are types), belonging to 9 genera and 37 species. The *Pneumorinae*, 57 specimens (1 a type), 4 genera and 10 species.

A collection of *Tetriginae* was sent to Dr. Joseph Hancock, of Chicago, for determination.

Miss Shelford was kind enough to devote much time to the mounting on durable paper of the drawings of Orthoptera made by the late Professor Westwood from specimens in continental Museums; these will be bound in book form and will constitute a valuable work of reference, as several of the type specimens from which the drawings were made have been lost.

6. *Specimens arranged for Display in the Upper South Corridor.*

The excessive amount of labour required by collections had, previous to 1906, prevented the devotion of any attention or time to the preparation of specimens for exhibition in the corridor outside the Hope Department. During the past year, however, two fine sets of South American butterflies have been arranged against the south wall by Mr. J. Collins. One of these groups represents the whole and the other nearly the whole of a single day's captures made upon the road from the Potaro River to the gold mines. The dominant species and types of colouring in that part of British Guiana are thus very clearly displayed, together with the remarkable series of variations in the most abundant species—*Melinaea mneme*—variations which effect the most gradual and perfect transition from a barred to a black hind wing. The remarkable prominence in the butterfly fauna of species entering into mimetic associations is also brought forward very conspicuously in the exhibit. Printed labels giving the names of the species have not yet been prepared, but in other respects the two groups are complete.

7. *The Material illustrated in Published Plates.*

During the past year, the material of several published plates on subjects of general biological interest, especially mimicry, has been arranged in a permanent form, and a copy of the corresponding plate placed beside each group. Thus naturalists will have the opportunity of easily studying the material, described and illustrated by memoirs which have been produced in association with the Hope Department. A beginning has been made with the plates accompanying Mr. R. Shelford's paper, *Observations on some Mimetic Insects and Spiders from Borneo and Singapore* (Proc. Zool. Soc. Lond., 1902, p. 230); Mr. S. A. Neave's paper on *Some bionomic notes on Butterflies from the Victoria Nyanza* (Trans. Ent. Soc. Lond., 1906, p. 207); and the Professor's paper, *Mimetic forms of Papilio dardanus* (*merope*) and *Acraea john-*

stoni (Trans. Ent. Soc. Lond., 1906, p. 281). It is hoped that the original specimens represented in the fifteen plates of Mr. Guy A. K. Marshall's great paper *On the Bionomics of South African Insects* (Trans. Ent. Soc. Lond., 1902, p. 287) will be similarly arranged, and carefully labelled for future reference and study. Such a collection of the material of published illustrations will eventually, it is expected, become a prominent feature of the Hope Department.

8. *Assistance in working out the Material of the Department.*

Colonel J. W. Yerbury, who has been so kind a friend to the Department for so many years, came to Oxford for some weeks in the early spring and completed the arrangement and, as far as possible, the determination of the Asilid flies. In previous years the *Dasypogoninae* and the *Laphrinae* had been completed, but by far the largest of the three sub-families, the *Asilinae*, had been hardly touched. The collection, since Colonel Yerbury's kind help, has been of the greatest value on many occasions, and especially in preparing the memoir on *Predaceous Insects and their Prey*, Part I, in which the *Asilidae* are treated more thoroughly than any other group of insects.

Mr. S. A. Neave, M.A., B.Sc., Magdalen College, on returning from his expedition to Northern Rhodesia, found his large collections of insects pinned and set. He spent much labour in arranging them according to their dates and localities, and in attaching the labels which were printed in the Department, and then again rearranging the collection approximately in systematic order, ready for determination. He was unable, however, to gather the fruit of all his work, for before the end of the year he had started on another expedition to Northern Rhodesia, hoping to explore the country and study the fauna further to the west as far as the coast. During his unavoidable absence various parts of the collection will be studied. Thus Mr. Shelford has already determined a large part of the Orthoptera, while the Hymenoptera are in the hands of Colonel C. T. Bingham, who is preparing a memoir upon African species of this order.

Monsieur H. Schouteden, of Brussels, examined the types of African Hemiptera, and kindly assisted in naming the most obscure and difficult of the Burchell specimens from this region.

Monsieur H. Boileau, of Paris, studied the collection of *Lucanidae*, and has undertaken to write a paper describing the features of special interest in the University collection of this group of beetles.

Dr. Albert Schulz, during a brief visit, examined some of the most obscure sections of the Hymenoptera Parasitica. He is engaged upon a memoir, for which a careful investigation of the late Professor Westwood's types of *Trigonalidae* has been necessary.

Mr. Rowland E. Turner visited the Department in order to see the collection of the remarkable Aculeate family, the *Thynnidae*, chiefly found in Australia. He has very kindly promised to help the University in the determination and arrangement of the species. With this view the whole material has been repinned, and fresh labels with the old determinations are being supplied to all the specimens.

Mr. W. J. Kaye came in order to help in the arrangement of the material, chiefly his own, but in part belonging to the Department, photographed by Mr. Robinson and reproduced in the four uncoloured plates of his memoir (Trans. Ent. Soc. Lond., 1906, p. 411).

Mr. Ernest A. Elliott brought a small collection of butterflies from the British East African Protectorate. Nearly all the species were named by comparison with the University collection, and Mr. Elliott generously presented several rare and interesting forms.

Very kind help with the *Lycaenidae* and *Hesperidae* has been rendered, as in previous years, by Mr. Hamilton H. Druce, F.L.S., F.E.S.

Monsieur Jules Bourgeois, of Ste Marie-aux-Mines, has continued the very kind assistance he has rendered in earlier years in the difficult task of determining the species in the large collection of Malacoderm Coleoptera, the group in

which he is the leading authority. His brother, Monsieur Octave Bourgeois, has also been extremely kind in carrying the specimens by hand from Paris to Ste Marie-aux-Mines and back, and in carefully keeping them until they could be brought by the same safe means of transit from Paris to Oxford.

Mr. Kenneth J. Morton, F.E.S., very kindly undertook to determine as far as possible the North American Odonata (Dragon-flies) in the Department. These were packed in four boxes and conveyed by hand to Edinburgh, and have now been returned. Professor Hudson Beare, F.E.S., kindly brought one consignment as far as London. Mr. Morton's identifications are now marked on all the specimens.

The large amount of kind assistance received by the Professor in working out the material of his memoir in Trans. Ent. Soc. Lond., 1906, p. 323, is fully acknowledged in the introduction. He wishes, however, again to express his special indebtedness to Colonel Yerbury for the large number of observations recorded in the paper, and for the immense amount of work involved in the determinations.

Commander J. J. Walker has most kindly continued his labours upon the British Coleoptera throughout the year. The first great divisions, the *Cicindelidae* and the *Carabidae*, are now ready for arrangement, and the completion of this important part of the work will be announced in next year's Report. This announcement will be accompanied by an expression of deep indebtedness to Mr. W. Holland for the generous gift of his own fine collection of these Coleoptera, which will be arranged at the same time as those already in the Department. All the data and all the determinations of the older specimens in the Hope Collection have been carefully retained, so that the new arrangement will preserve all that is valuable and historic in the old.

Dr. F. A. Dixey has incorporated in the collection of *Pierinae* the very large accessions that have come in during the year—a very considerable labour involving much re-arrangement. He has also published a number of communica-

tions on important subjects connected with the *Pierinae*, and devoted much time to an extensive memoir upon the group which will appear, it is hoped, at no distant date.

In addition to the work upon the Library, already spoken of under Section 5, Miss Shelford has rendered most kind assistance in setting a number of South African and Bornean insects.

The kindest assistance has been rendered, as in previous years, by the staff of the Insect Department of the British Natural History Museum, where also Mr. G. A. K. Marshall has often given much valuable help.

9. *Visits of Naturalists.*

The annual visit of members of the Council of the Entomological Society of London took place on June 30–July 1. There were present—The President, Mr. F. E. Merrifield, the Secretary, Commander J. J. Walker, R.N., Hon. M.A., F.L.S., and the following members of Council:—Mr. G. J. Arrow, Mr. A. J. Chitty, M.A., Balliol College, Mr. J. E. Collin, Dr. F. A. Dixey, D.M., Wadham College, Mr. R. Standen, F.L.S., and Professor E. B. Poulton. Mr. G. H. Verrall, an ex-President of the Society, was also present, together with the following naturalists:—Mr. Guy A. K. Marshall, Mr. S. A. Neave, M.A., B.Sc., Magdalen College, Mr. R. Shelford, M.A., Emmanuel College, Cambridge. The Junior Proctor, Dr. F. A. Dixey, and the Professor represented the Hope Curators. Two events came to pass just in time to confer additional interest upon the visit: the arrival of the historic J. C. Dale Collection of British Insects, and the appearance of the fifth volume of Hope Reports. Mr. G. H. Verrall and Mr. J. E. Collin were especially glad to have the opportunity of studying the Dale Diptera, while other sections of the collections were also examined with much interest.

The Hope Department has, in the course of the year, received visits from the following naturalists, who have contributed largely to the collections:—Mr. G. A. K. Marshall

(on three occasions). Dr. Karl Jordan (two visits), Herr Ed. L. Lorenz Meyer, who has given fine collections from the Malayan region and from Europe, Captain T. T. Behrens, R.E., Mr. G. C. Champion, Mr. W. J. Lucas (twice), Professor T. Hudson Beare, Mr. W. J. Kaye, Mr. E. A. Cockayne, M.A., Balliol College (twice), Dr. F. Jenkinson, Hon. D.Litt., and Mr. S. A. Neave, M.A., B.Sc. (several times). Mr. E. M. Hopkinson, who has presented valuable specimens from the neighbourhood of Bathurst, Gambia, visited Oxford when the Professor was unfortunately away. It was a pleasure to be able to show something of the collection to H.H. the Rajah of Sarawak, G.C.M.G., whose museum at Kuching has sent such generous donations of Bornean insects. Mr. F. C. Selous, in the course of a brief visit, gave valuable information concerning specimens collected by him in Matabeleland.

The Department has also been visited by Professor H. E. Armstrong, F.R.S., Mr. Oldfield Thomas, F.R.S., and Mr. W. H. Heathcote, of Preston.

10. *Work published in* 1906.

The following papers by workers in the Hope Department or upon its material have appeared in the Transactions of the Entomological Society of London during the year 1906 :—

Read Feb. 5.—On some Bionomic points in certain South African Lamellicorns, by Dr. G. B. Longstaff, D.M., F.E.S.

Read March 7.—Some Rest-Attitudes of Butterflies, by Dr. G. B. Longstaff, D.M., F.E.S.

Read March 7.—Notes upon some remarkable parasitic insects from North Queensland, by F. P. Dodd, F.E.S., with an Appendix containing descriptions of New Species, by Colonel Charles T. Bingham and Dr. Benno Wandolleck.

Read June 6.—Some Bionomic notes on Butterflies from the Victoria Nyanza, by S. A. Neave, M.A., B.Sc., F.E.S., Magdalen College, Oxford.

Read June 6.—On the Habits of a Species of *Ptyelus* in British East Africa, by S. L. Hinde, communicated with Notes by the Professor.

Read June 6.—Studies of the *Blattidae*, by R. Shelford, M.A., F.L.S.

Read June 6.—Mimetic Forms of *Papilio dardanus* (*merope*) and *Acraea johnstoni*, by the Professor.

Read June 6.—Predaceous Insects and their Prey, Part I, by the Professor.

Read Oct. 3.—Notes on the dominant Müllerian group of Butterflies from the Potaro District of British Guiana, by W. J. Kaye, F.E.S.

Read Oct. 17.—A note on the Cryptic Resemblance of two South American Insects, the moth *Draconia rusina*, Druce, and the Locustid, *Plagioptera bicordata*, Serv., by the Professor.

Read Nov. 21.—Studies of the *Blattidae* (*continued*), by R. Shelford, M.A., F.L.S.

Read Dec. 5.—On the Diaposematic Resemblance between *Huphina corva* and *Ixias baliensis*, by Dr. F. A. Dixey.

Mr. W. J. Kaye's paper, read Oct. 3, is included in the above list, and will, with the author's consent, appear in a future volume of Hope Reports. A part of the material represented in the plates belongs to the Department, while the whole of the five plates were arranged here, and the four uncoloured ones photographed for half-tone reproduction, by Mr. Alfred Robinson.

The following short papers have appeared in the Proceedings of the Entomological Society of London during the year 1906:—

Feb. 7.—Scents of South African Butterflies, by Dr. F. A. Dixey.

Interesting species of *Acraea* from the Victoria Falls, by Dr. G. B. Longstaff.

The fly *Chortophila unilineata*, following the bee *Andrena labialis*, by A. H. Hamm.

March 7.—W. J. Burchell's original African Journal, from May 24 to Sept. 2, 1812, by the Professor.

Eye-like spots on an Oriental chafer, by the Professor.

Reddish tints on the dry phase undersides of Pierine butterflies, by Dr. F. A. Dixey.

March 21.—Mimicry by the related Pierine genera, *Eronia*, *Nepheronia*, and *Leuceronia*, by Dr. F. A. Dixey.

May 2.—Mimicry between two African Pierine genera much closer in the dry season than in the wet, by Dr. F. A. Dixey.

A criticism of the late Professor Packard's paper on the markings of Organisms, by H. Eltringham, M.A., F.Z.S.

June 6.—On 153 Pierine butterflies, captured in a single sweep of the net by Mr. C. A. Wiggins, near the Rippon Falls, Jinja, Victoria Nyanza, on Feb. 2, 1906, by Dr. F. A. Dixey.

Notes on Natal butterflies, by the late Mr. Geo. H. Burn, of Weenen, Natal, communicated by the Professor.

Notes on *Euralia wahlbergi* and *E. mima*, by Mr. G. F. Leigh, F.E.S., of Durban, communicated, with exhibition of specimens, by the Professor.

The proof by breeding that *Precis tukuoa* is the wet season form of *P. ceryne*, by Guy A. K. Marshall, F.E.S., F.Z.S., with exhibition of the specimens, by the Professor.

On *Precis sesamus* (8 dry phase, 1 intermediate and 1 wet), captured Sept. 1905, on the slopes of Kilimanjaro, by Rev. K. St. Aubyn Rogers, M.A., with exhibition of the specimens, by the Professor.

On 325 butterflies captured on Feb. 23, 1904, by Mr. C. B. Roberts, near the Potaro River, British Guiana, by the Professor.

On the association of two British insect mimics with their respective models in the living state, by Mr. W. Holland.

Note on a feeding experiment on the spider *Nephila maculata*, by R. Shelford, M.A., F.E.S., F.Z.S.

Oct. 3.—Diaposematic resemblance between *Nychitona medusa* and other Pierine butterflies, and between it and *Pseudopontia paradoxa*, by Dr. F. A. Dixey.

Diaposematic resemblance between *Ixias baliensis* and *Huphina corva* in the island of Bali, by Dr. F. A. Dixey.

Remarkable and interesting butterflies from N. E. Rhodesia, with examples of mimicry and of seasonal phases, by S. A. Neave, M.A., B.Sc.

Nov. 7.—On a remarkable specimen of *Panorpa germanica*, taken by Mr. E. A. Cockayne, F.E.S., at Tongue, Sutherlandshire, by W. J. Lucas, B.A., F.E.S.

Illustrations of the phenomena of melanism in *Pierinae*, by Dr. F. A. Dixey.

Mimetic resemblance between the wet phase under side of *Teracolus regina* and forms of *Belenois*, by Dr. F. A. Dixey.

Further notes on the choice of a resting site by *Pieris rapae*, by A. H. Hamm.

Dec. 5.—Guy A. K. Marshall's experiments with temperature and humidity upon the larval and pupal stages of *Teracolus omphale*, by Dr. F. A. Dixey.

Dr. Dixey's paper on *Ixias* and *Huphina*, read October 3, is included in the above list from the Proceedings as well as in that from the Transactions of the Entomological Society, because the former is not a mere title or brief abstract, but contains a substantial account of the subject.

In addition to these papers in the publications of the Entomological Society, the following appeared in the Entomologist's Monthly Magazine for June, pp. 121–128:—Observations on Indian Butterflies, by T. R. Bell. This paper, full of interesting notes and observations, was compiled from the author's correspondence with the Professor.

The above statement does not by any means give a complete account of the researches conducted in the Department during 1906, for other pieces of work already published or to be published in 1907 were entirely or in great part carried out in 1906. Thus two important papers on *Blattidae*, by Mr. Shelford, have already appeared; Dr. Dixey has done much towards the completion of a memoir which, it is hoped, will be published during the present year, while the Professor had in 1906, with much help from friends, prepared nearly the whole of the MSS. of Part II of *Predaceous Insects and their Prey*. The materials of his lecture on W. J. Burchell, delivered at Cape Town, August 17, 1905, and in chief part prepared for publication in 1906, appeared in the early part of the present year.

11. *Fifth volume of Hope Reports.*

By the middle of the year it became evident that the accumulation of separata rendered it expedient to issue a fifth volume of Reports. The volume, dated June 25, 1906, is considerably larger than any of those which preceded it. It contains reprints of papers published 1903–1906, although many of those which appeared in 1903 formed part of the fourth volume, while the great majority of those published in 1906 are reserved for the sixth volume. This latter should appear in the course of the present year.

12. *Exchange of Hope Reports with the publications of Foreign Entomological Societies.*

The number of Entomological Societies all over the world which sent their publications to Professor Westwood, rendered the Hope Library extremely efficient in this, the most important part of the literature of a science. After his death at the close of 1892, nearly all these series, in many cases complete from the commencement, came to an end, for the income of the Department was quite unable to bear the heavy expense of purchasing so many annual publications. Although it was obvious that the difficulty would increase with every year in arrear, the Professor hoped that it might be possible in the future, as the work of the Department developed, to arrange an exchange of publications. The appearance of the fifth volume of Hope Reports in the summer of 1906 seemed a suitable stage at which to enter upon negotiations. The Entomological Societies of Berlin and Stockholm were approached, and courteously consented to exchange their publications from 1893 to 1906 inclusive for the 5 volumes of Hope Reports, and hereafter to exchange regularly. In the case of the Berlin Society with the more extensive publications, a very moderate payment was asked for half the years in arrear. The Professor desires to acknowledge the extremely generous manner in which the Hope Department was treated by these two Societies, and to express his

thanks to Professor Chr. Aurivillius of Stockholm, and Dr. Walther Horn, of Berlin, for their courteous communications on the subject.

Additions to the Collections in 1895.

A set of 30 *Acridiidae* and 1 *Decticus sp.* (*Locustidae*) captured by the Professor, at the end of August and beginning of September, 1895, near the Hotel Weishorn, above Vissoye in the Val d'Anniviers, Switzerland, were catalogued and added to the collection of Orthoptera. Five Hemiptera and an ant collected at the same time were also incorporated. The *Acridiidae*, kindly named by Dr. David Sharp, F.R.S., formed the subject of a paper *On the Courtship of certain European Acridiidae*, by the Professor (Trans. Ent. Soc. Lond., 1896, p. 233).

Additions to the Collections in 1900.

Thirty-five *Mantidae* (33 catalogued); 2 *Phasmidae* (1 catalogued); 118 *Acridiidae* (92 catalogued); 35 *Locustidae* (34 catalogued); 49 *Gryllidae* (48 catalogued); from the De Bormans collection of Orthoptera, purchased in 1900, were labelled, catalogued and added to the University Collection.

Seventeen *Mantidae* collected at various dates in the neighbourhood of Kuching, Sarawak, N. W. Borneo, were presented by R. Shelford, Esq., M.A., Emmanuel College, Cambridge, F.L.S., F.E.S.

A large amount of time was occupied in sorting, cataloguing and incorporating the splendid collection of Bornean insects of many Orders presented by R. Shelford, Esq., in the years 1899–1901, when he was Curator of the Sarawak Museum, Kuching, N. W. Borneo. The pinning, setting, and labelling had been completed many years ago, but the numbers are so great that the final stages have proved to be a serious undertaking. Very little now remains to be done. The extent of this magnificent donation may be inferred from the

numbers of specimens catalogued. All have been entered for 1900, the year when the great majority were presented. The numbers catalogued and incorporated are:—Coleoptera, 2,201; Aculeate Hymenoptera, 593; Rhynchota, 1,051; Orthoptera (in addition to those acknowledged above), 412.

Additions to the Collections in 1901.

Five *Mantidae* from Port Bou, and Cerbère at the Eastern end of the Pyrenees, and an immature Mantid from Majorca (June, July, 1901), were presented by the captors, Mr. W. Holland and Mr. A. H. Hamm.

Additions to the Collections in 1902.

A valuable set of 63 named *Staphylinidae* (47 catalogued) from various British and Irish localities were presented by W. E. Sharp, Esq., F.E.S. Specimens of this difficult group thus named by a special student of the Family are an important accession to the Department.

Two hundred and forty-eight insects of various Orders from Rosaires and Wad Medine (both October, 1901) on the Blue Nile, and from various localities between Mangala and Gondokoro (Jan.–Apr., 1902) on the White Nile, were presented by the captor, W. L. S. Loat, Esq., F.Z.S. The data are full and precise, rendering the specimens from such interesting localities of great value to the collection; nearly the whole are catalogued. The series included a Blattid, *Holocompsa fulva*, from the Blue Nile, new to the Department.

Additions to the Collections in 1903.

A valuable series of insects, chiefly Coleoptera, and almost exclusively from various localities in Natal, especially from the neighbourhood of Durban (1889–1903), were presented by C. N. Barker, Esq., F.E.S. A small number of insects from Chimoio, Mozambique and Grahamstown are also present. The series includes a valuable set of 98 Lycid beetles, many captured *in coitu.* The latter record is an important

aid in the correct determination of these difficult species. Several insects of different Orders enter into mimetic associations, and have been placed in the bionomic collection. Nearly the whole of this interesting set of specimens is catalogued. In addition to the above 2 Asilid flies with their prey (Nos. 113 and 125 in *Predaceous Insects and their Prey*, Trans. Ent. Soc. Lond., 1906, p. 323) were presented by the same kind donor.

Four hundred and forty-five *Mantidae* from the fine collection of Orthoptera presented by Malcolm Burr, Esq., M.A., New College, have been incorporated in the general collection. Almost exactly half the number are catalogued.

A male and female of an exceedingly fine new species of Buprestid beetle recently described as *Sternocera druryi*, C. O. Waterhouse, were presented by Dr. A. J. Hayes. The specimens were captured *in coitu* by the donor near Gadarif in the Soudan (Feb , 1903). The species was described from a single individual in the British Museum, but Dr. Hayes' specimens were also studied by the author and have become co-types. Dr. Hayes also presented an example of *Mylabris hybrida*, a beetle said to be destructive of crops in the Soudan.

Fifty-three specimens of insects of various Orders, many of them illustrating bionomic principles, were presented by F. Muir, Esq. They were captured by the donor in 1902–3 at various localities in the neighbourhood of Durban. The collection includes 4 examples of Asilid flies and their prey (Nos. 79, 124, 126, 127, in *Predaceous Insects and their Prey*); also a number of Hymenoptera with their Dipterous mimics; Lycid beetles and their mimics; ants and their mimics, both Hemipterous and Orthopterous. A particularly interesting specimen is an injured example of the butterfly *Protogoniomorpha nebulosa*, captured May 12, 1902, at Stella Bush, near Durban. The butterfly was settled on the under side of a leaf when Mr. Muir saw a bird dart at it and tear away about one-third of both hind wings. The bird *just* missed the body of the butterfly. The specimen thus affords the strongest support to the interpretation of numbers of speci-

mens exhibiting similar symmetrical injuries presented by Mr. Guy A. K. Marshall (Trans. Ent. Soc. Lond., pp. 366–375, Plates IX–XI).

ADDITIONS TO THE COLLECTIONS IN 1904.

A large collection of many hundreds of butterflies and a few other insects collected by natives (1898–9) at Kayambi, Awemba, near the sources of the Congo (Chambezi) River, in North-Eastern Rhodesia, was presented by H. A. Byatt, Esq., B.A., Lincoln College. The specimens were given to the donor by Père Guillemé, of the White Fathers' Mission to Central Africa. Unfortunately exposure to the damp atmosphere of several wet seasons has altered the pigments, and a large proportion of the specimens were also injured by mould and the attacks of insect pests. In spite of this, large numbers have been added to the collection, although it was considered better not to catalogue any of them. Many species of great interest and rarity were present; the most interesting being a long series (17 specimens) of *Pseudacraea poggei*, one of the most beautiful mimics of *Limnas chrysippus*, and hitherto looked upon as one of the scarcest. This unexpected abundance enabled Mr. Byatt to publish an account of the proportion borne by the mimic to the model: it came out at a little under 5% (Trans. Ent. Soc. Lond., 1905, p. 263). A single specimen out of 367 otherwise typical *L. chrysippus* was a rare monstrosity with 5 wings, shown in Plate XIV, fig. 1, accompanying Mr. Byatt's paper. This deeply interesting mimic, *Pseudacraea poggei*, is now added to the collection for the first time. Another rare mimic also present, represented by a single specimen, is *Crenidomimas concordia*.

Considering the interest of the locality and the number of rare specimens, it is very unfortunate that the collection had been damaged by damp. But even in its present state it has added numbers of interesting accessions to the Department.

An example of the rare hawk-moth, *Nephele argentifera*, an Asilid fly, and a collection of 128 beetles, all from the neighbourhood of Malvern, near Durban, were presented by

the captor, C. N. Barker, Esq., F.E.S. The great majority were captured in 1903–4. Many specimens are of great value to the Department, and all are much wanted, inasmuch as Natal representatives in the University Collection are, except in Lepidoptera, comparatively few.

Twenty-six butterflies (12 catalogued) from Howrah, near Calcutta (Jan., 1904); 15 butterflies (6 catalogued) from Mandalay (Feb., 1904); 14 butterflies (8 catalogued) from the neighbourhood of Modah, between Bhamo and Katha, Upper Burma (March, 1904), were presented by the captor, Miss Katherine Worrall. Some interesting examples of injuries, probably caused by the attacks of enemies, were included in the collection. These have been added to the bionomic series.

Fifteen examples (13 catalogued) of the black ant, *Paltothyreus tarsatus*, captured at Mapellapveda, 45 miles N.W. of Palapye Rd. Station (1904), by S. Blackbeard, Esq., were presented by Dr. Selmar Schönland, Hon. M.A., Curator of the Albany Museum at Grahamstown. These ants when disturbed defend themselves by emitting an intolerable odour like that of putrid meat. The specimens were exhibited, and Dr. Schönland's notes read, at the meeting on June 1, 1904, of the Entomological Society of London (see Proceedings, 1904, pp. xl–xli).

The following valuable set of specimens has been presented by G. C. Griffiths, Esq., F.E.S., who has so often aided the Hope Department:—

One hundred and eighty-four Coleoptera (115 catalogued) from Assam, Madagascar, the neighbourhood of Toronto, and of Jacksonville, Florida. The American specimens were collected (those from the last-mentioned locality about 1886) by E. N. Collins, Esq.

Twenty-two specimens (11 catalogued) of insects of various Orders, and Acarina from East Africa, probably Mombasa.

Twenty-five butterflies (12 catalogued) from Yokohama, Nikko, Asama, and Hakone, Japan, collected (1902–3) by T. Z. Takano, Esq.

Additions to the Collections in 1905.

A very fine and interesting series of butterflies from the following localities in the British East African Protectorate and in the adjacent German territory to the south, were presented by the captor, the Rev. K. St. Aubyn Rogers, M.A., Wadham College:—

Mombasa (1904–5): 115 specimens, of which 66 are catalogued, and many others added to the collection. The species include *Neptidopsis fulgurata*, *Acraea crystallina*, and *Hypolycaena pachalica*, all greatly wanted. A bred set of *Belenois severina* is also of great interest in estimating the amount of variability within the limits of a single family.

Taveta, about 2,500 ft. (1905): 647 specimens (including three moths), of which 311 are catalogued and many others added. The collection includes a fine representative series of butterflies from this most interesting locality. Four specimens, exhibiting injuries probably inflicted by enemies, have been added to the bionomic series. A Lycaenid butterfly, *Pentila amenaida*, and Geometrid moth, *Petovia dichroaria*, captured on the same day, Dec. 9, 1905, have been placed in the mimicry collection. They are described by the donor as closely resembling each other on the wing. The case is of special interest, inasmuch as this same species of moth was found by Mr. Guy Marshall in Natal, flying with and closely resembling on the wing a Lycaenid of a different genus—*Alaena amazoula* (Trans. Ent. Soc. Lond., 1902, pp. 497–8). It is probable that the resemblance is Müllerian (synaposematic) in both cases.

Taita, 3,000 ft., and Dabida, 3,500 ft., about 100 miles N.W. of Mombasa (May, June, 1905): a set of 13 butterflies (2 catalogued).

Forest near Pangani River, Kitovu, S.W. of Taveta (Dec., 1905): seven butterflies, of which the 4 catalogued include a pair of *Lachnoptera ayresii*.

Maketan, about 3,800 ft., between Burra and Taveta (May, 1905): eleven butterflies, of which *Acraea chilo* is the only one catalogued.

Voi River, about 2,000 ft. (June, 1905): a fine male of *Papilio dardanus* (*merope*), sub-sp. *tibullus*.

Nairobi, 5,500 ft. (Dec., 1904): sixteen butterflies, of which 7 are catalogued.

Kilimanjaro: several sets of butterflies and a few moths from this interesting mountain were presented by the same generous donor:—

Slopes of the mountain (Dec. 15–31, 1905); native collectors: 57 butterflies and 1 moth, of which 37 are catalogued and several others added. A useful and varied series of specimens.

S.E. slopes; Marang State (Sept., 1905); collected by the donor: 18 butterflies, of which 11 are catalogued.

S.E. slopes; Mamba State (Sept., 1905); collected by the donor: 135 butterflies, of which 51 are catalogued and many others incorporated. The series includes a fine set of *Colias electra*:—5 males, 8 orange females, and 8 white females; also a set of 8 dry-season (one from Marang State), 1 intermediate and 1 wet-season, *Precis sesamus*, captured Sept. 19–25. Nearly all except the wet form were more or less chipped and worn, and had evidently been upon the wing for a considerable time. The single wet-season specimen was a male, and it was captured *in coitu* with a worn dry-season female. It is probable that the specimens of the dry season were coming to an end, and that one of the early wet forms could find no female of its own phase, and paired with one of the other phase, which was still abundant. The donor also sent valuable notes on the climate and seasons of Kilimanjaro, which will be of great use in the attempt to understand the phenomena presented by this extraordinary butterfly. These notes and some account of the specimens of *Precis sesamus* are published in the Proc. Ent. Soc. Lond., 1906, pp. lviii–lx.

Slopes of the mountain (May, 1905): a set of 16 butterflies and 2 moths (6 catalogued).

Western slopes of the mountain, Kibosa, about 5,000 ft. (Nov. 1, 1905): two fine ♂ *Charaxes cithaeron* and 1 ♀ *Planema quadricolor*. The latter, being in poor condition, is

uncatalogued, but it is the sole representative of the species in the systematic collection.

In addition to the specimens mentioned above, the whole series of butterflies from Kilimanjaro was examined, in order to select the set of 9 specimens figured in Trans. Ent. Soc. Lond., 1906, Plate XXI, showing the wonderful mimetic forms of the protean *Acraea johnstoni* and their Danaine and Acraeine models. A magnificent variety of the same mimicking *Acraea* from Taveta is shown in the succeeding Plate, Fig. 2 a. All these are catalogued as part of the mimicry collection, and will be retained in the relative positions which they occupy in the Plates.

Owing to the number and kindness of English friends in Africa, the Ethiopian collection of Rhopalocera at Oxford is becoming a very notable one. Of these generous donors, the specimens contributed by the three following naturalists are remarkable for their numbers and the admirable data which accompany them:—Mr. Guy A. K. Marshall, Mr. C. A. Wiggins, and Rev. K. St. Aubyn Rogers. The above brief account of the specimens presented by Mr. St. Aubyn Rogers in a single year will give some idea of the extent of his generous assistance to the Hope Department.

Three butterflies from Gazaland, S.E. Rhodesia (1905), were presented by the captor, G. A. K. Marshall, Esq., together with 121 Hymenoptera, Hemiptera, and Orthoptera taken at Salisbury, Mashonaland (1895).

Two specimens of a dark-hind-winged species of *Protogonius* from Cayenne (Jan., 1904) were presented by W. Schaus, Esq., F.Z.S. They constitute an important and deeply interesting addition to the large group of dark-hind-winged butterflies characteristic of that part of South America.

The following examples of *Predaceous Insects and their Prey* were presented in 1905:—

No. 129 by Rev. K. St. Aubyn Rogers, M.A., Wadham College.
„ 140 „ Lieut. T. Bainbrigge Fletcher, R.N.
„ 296 „ A. H. Hamm.

No. 164 „ E. Saunders, F.R.S.
„ 197 „ Dr. T. A. Chapman.
„ 257 „ Dr. G. B. Longstaff.

The full data will be found under these numbers in the published paper (Trans. Ent. Soc. Lond., 1906, pp. 323-409).

Additions to the British Collections in 1905.

A splendid series of 1,830 named British flies were presented by the captor, Colonel J. W. Yerbury. The following list is taken from a good representative set of locality-labels which have been selected to fix in the catalogue book. Without pretending to be complete in localities or dates, the list gives some idea of the great interest of this fine addition to the British collections. Specimens were captured by the kind donor at various localities in the following Scotch counties:—Sutherlandshire (1884–1904), Haddingtonshire (1899), Inverness (1898–1905), Caithness (1899), Nairnshire (1904–5), Perthshire (1896–1904), Banffshire (1900), Elginshire (1899); in County Kerry (1902); in various localities in N. Wales (1902) and S. Wales (1899–1903); in the following English counties:—Hampshire (1897–1905), Kent (1896–1903), Surrey (1897–1903), Somerset (1903), Gloucestershire (1903), Herefordshire (1897–1902), Suffolk (1900), Yorkshire (1905). The great majority of the species have been named by Col. Yerbury himself; many by Mr. G. H. Verrall and by Mr. J. E. Collin.

Colonel Yerbury also presented a specimen of 2 Fossorial wasps with their prey: *Salius fuscus* with a spider, from Nethy Bridge, Spey Valley, Inverness (June, 1905), and *Mellinus arvensis* with the fly, *Euphoria cornicina*, from Golspie, Sutherland (Aug. 1900).

With this fine accession, which repeats Colonel Yerbury's generous assistance in former years, the series of British Diptera is rapidly developing into a valuable collection of reference. The species are, in nearly all cases, represented by a fine series of individuals, often from many localities.

A valuable set of 59 British Coleoptera were presented by the Rev. G. A. Crawshay, F.E.S. The great majority were captured (1899–1904) by the donor near Leighton Buzzard, in various localities in the south of England, and a few in Yorkshire. The collection includes 5 specimens of *Amara infima*, hitherto only recorded from Surrey; 2 of the first specimens of *Amara anthobia*, to be recognized as distinct from *A. lucida*; 1 *Harpalus discoideus*, very local; 2 *Corymbites metallicus* and 1 *Saprinus metallicus*, local and rare; 2 *Metoecus paradoxus*, parasitic in the nests of wasps; also the following beetles, all more or less local and rare: *Notiophilus rufipes*, *Necrophorus vestigator*, *Cryptocephalus punctiger*, *Crepidodera nitidula*, *Trachodes hispidus*.

The following Fossorial wasps, four of them with prey, were presented by the captor, Mr. J. Collins, of the Hope Department: 2 *Pompilus plumbeus*, each with a spider; 1 *Oxybelus uniglumis*, with a fly; also 2 *Agenia variegata*, taken with the former specimens at Tubney Wood, near Oxford (July, 1905); 1 *Stigmus solskyi* with an Aphid, from Sunnymead, near Oxford (July, 1905).

Additions to the Collections in 1906.

Twenty-two beetles, chiefly *Coccinellidae*, from various localities in Sarawak, N.W. Borneo, were presented by R. Shelford, Esq., M.A., F.L.S., F.E.S., Emmanuel College, Cambridge.

Twenty-three Orthoptera (chiefly *Blattidae*, but also including *Mantidae* and a Forficulid), from the following localities: New Zealand, Madagascar, Teneriffe, Borneo, Assam, Venezuela, British Guiana, and Brazil, were presented by R. Shelford, Esq.

One hundred and thirty-eight insects of many Orders captured in the Botanic Gardens, Singapore (Feb.–Sept., 1906), by H. N. Ridley, Esq., M.A., F.R.S., Exeter College, were presented by R. Shelford, Esq. The great majority were much wanted by the Department, and 104 are catalogued.

A valuable series of 23 specimens of *Blattidae* from W.

Africa, Madagascar, the Malay Archipelago, and Cayenne was presented by R. Shelford, Esq.

Seven Orthoptera from the Botanic Gardens, Singapore (Feb.–April, 1906), were presented by the captor, H. N. Ridley, Esq., M.A., F.R.S., Exeter College.

Fifty-four insects of various Orders from the Botanic Gardens, Singapore (Feb.–April, 1906), were presented by the captor, H. N. Ridley, Esq.

Four European *Blattidae* (2 *Ectobia vittiventris*, 1 *E. nicaeensis*, 1 *Hololampra carpetana*), new to the Hope Collection, were presented by Malcolm Burr, Esq., M.A., F.G.S., F.E.S., New College.

The following specimens were presented by Commander J. J. Walker, R.N., Hon. M.A., Sec. E. S.: 9 *Blattidae* and 1 *Gryllotalpa* from Sydney.

Twelve *Forficulidae* (Earwigs), 13 *Blattidae* and 1 aquatic Hemipteron from Sydney, N.S.W. (1900).

An Achetid and a Locustid from the New Hebrides (1900).

A male and female of the type form of *Colias vautieri*, and a pair of the small variety *minuscula* from Chile (1882–4).

All the above specimens were captured by the donor, and the data are precise and full, as in all Commander Walker's specimens.

An example of the interesting dwarf form of *Colias hyale* from Massowah, captured April, 1899, by Lieut. Constable, was also presented by Commander J. J. Walker.

Four *Blattidae* from Tretes, E. Java, 3,600 ft. (Feb. 1906), together with four from Kaimana, Dutch New Guinea, sea-level (Nov. 1905), were presented by the captor, H. C. Pratt, Esq.

A fine Asilid fly, *Lamyra sp.* ?*gulo*, thirty-six *Blattidae* and 18 *Mantidae* from various localities in N.E. and N.W. Rhodesia (1904–5) were presented by the captor, S. A. Neave, Esq., M.A., B.Sc., Magdalen College, in conjunction with the British South African Company. The data are excellent and precise, and Mr. Shelford considers that there are several new species among the *Blattidae*.

Six *Blattidae*, including 2 examples of the interesting mimetic cockroach *Eustegaster buprestoides*, from Fernando Po, were presented by the Musée d'Histoire Naturelle, Paris.

Twelve *Blattidae* and 125 other Orthoptera from various localities in Sarawak, N.W. Borneo, were presented by the Sarawak Museum, Kuching. All except 6 imperfect specimens are catalogued.

Ten Coleoptera, including two *Histeridae* named by G. Lewis, Esq., and several *Coccinellidae* and their mimics were presented by J. Hewitt, Esq., B.A., Jesus College, Cambridge, Curator of the Sarawak Museum, Kuching. The specimens were collected in various localities in the State of Sarawak. It was a pleasure to be able to help Mr. Hewitt with the names of the specimens, so far as they belong to described species.

The following examples of the remarkable dark-hind-winged group of butterflies from British Guiana were presented by W. J. Kaye, Esq., F.E.S.: 1 *Lycorea ceres*, 1 *Lycorea pasinuntia* (catalogued), 1 *Heliconius numata*. All were captured near the Potaro River, 30 miles above the confluence with the Essequibo (1901, 1905).

Eighty-four insects and 1 spider from Bangalore, Mysore (1901–2), were presented by Captain T. D. Broughton, R.E. The great majority of the specimens are Hymenoptera. The specimens were, unfortunately, much damaged in the post, so that it was only possible to catalogue 25 of them as permanent accessions. In addition to the above, a large number had been injured beyond the possibility of repair.

Two hundred and fifty-four butterflies from the Andaman Islands (1903), and 164 from the Nicobar Islands (1904), were presented by Lieut. Gilbert Rogers: 163 specimens from the former locality, and 92 from the latter have been catalogued. The collection is of great value to the Department, and the thanks of the University are due, not only to the generous donor, but to Colonel C. T. Bingham, who kindly brought to his notice the needs of the Hope Department.

Forty Coleoptera Phytophaga from various localities,

including co-types of two species shortly to be described by the donor, were presented by M. Jacoby, Esq., F.E.S.

A set of 6 ♂ and 5 ♀ specimens of the Asilid fly *Promachus anicius*, from Macao (May, 1906), was presented by the captor, J. C. Kershaw, Esq. In two cases the specimens had been taken *in coitu*. These insects had unfortunately become damp and mouldy, and it was therefore impossible to catalogue them, although they have been incorporated in the collection.

Many specimens illustrating *Notes upon some remarkable parasitic insects from North Queensland* were presented by the author, F. P. Dodd, Esq., F.E.S. This interesting and valuable material includes the following types of Hymenoptera Parasitica described by Col. C. T. Bingham: *Apanteles deliadis*, together with its hyper-parasite *Microterys coeruleus*, the former bred from the larva of the Pierine butterfly *Delias argenthona*; *Microgaster basalis*, with the moth larvae from which it was bred; *Microgaster perelegans*; *Protapanteles rufiventris*; *Stomatoceras fasciatipennis*; *Rhipipallus affinis*; *Schizaspidia doddi*. The specimens illustrate many new observations upon the life-histories of parasites. Thus the genus of the last-named species, a remarkable and beautiful Chalcidid, was described by Professor Westwood, but the host has never been known. Mr. Dodd has, however, shown that, in the case of *S. doddi*, it is a large ant of the genus *Camponotus*. The collection also includes the host (the Attid spider *Cosmophasis bitaeniata*) from which a new species of Cyrtid fly was bred, *Ogcodes doddi*. The type of the latter is in Dr. Wandolleck's famous collection at Dresden. This deeply interesting material is catalogued under 35 numbers, but the specimens are far more numerous, inasmuch as several of the cards bear many individuals.

A large amount of the material described in the memoir *Predaceous Insects and their Prey* (Trans. Ent. Soc. Lond., 1906, pp. 323–409) was presented during the year 1906 by the following naturalists. *Asilidae* and their prey constitute the great majority of the examples indicated by the numbers.

A full account of the data will be found in the paper itself under the respective reference numbers.

Nos. 60, 118–121, presented by J. C. Kershaw, F.E.S.

Nos. 55, 89, 220–224, 339, presented by Dr. T. A. Chapman, F.E.S.

No. 84, presented by Captain T. D. Broughton, R.E., F.E.S.

Nos. 91, 130, 136, 346, presented by G. A. K. Marshall, F Z.S., F.E.S.

Nos. 92, 137, 138, presented by S. A. Neave, M.A., B.Sc., F.E.S.

No. 150, presented by the Professor.

No. 155, presented by Col. J. W. Yerbury, F.L.S., F.E S.

Nos. 156, 315, 333, presented by W. J. Lucas, B.A., F.E.S.

Nos. 167, 205, 212, 213, 232, presented by A. H. Hamm.

No. 186, presented by G. H. Verrall, F.E.S.

Nos. 214, 215, presented by J. Collins.

Nos. 233, 264–272, 342, 343, presented by H. St. J. K. Donisthorpe, F.Z.S., F.E.S.

No. 273, presented by R. Shelford, M.A., F.L.S., F.E.S.

No. 328, presented by E. A. Cockayne, B.A., F.E.S.

From this point onwards the catalogued 1906 specimens incorporated in the general collections are exclusively Ethiopian: an indication of the important increase in the representation of this interesting region which is yearly taking place.

Two hundred and eighty-four butterflies and seven moths from the neighbourhood of the Victoria Nyanza (1902–3) were presented by Captain T. T. Behrens, R.E. Of these 164 have been catalogued as permanent accessions, and the others, generally in poor condition, also added to the collection. The great majority were captured on the West shore between Entebbe and the Anglo-German Boundary, and along the Boundary itself for a distance of 60 miles from the lake. Until Captain Behrens' kind donation the University collections did not include any specimens from the Nyanza south of Entebbe. The following are among the most interesting accessions:—A male example of *Papilio mimeticus*, together with several examples of its model, *Melinda mercedonia*

(model and mimic are figured in Mr. S. A. Neave's paper in Trans. Ent. Soc. Lond., 1906, Pl. XII, figs. 4, 5). Three examples of the *planemoides* form of the female *Papilio dardanus*, sub-sp. *merope*, one of which is gynandromorphic on the left side. The intermixture of the very different male colouring confirms the conclusion that this form of female has been rightly associated with the *dardanus* group—a conclusion not hitherto supported by breeding or by observing the forms paired. This deeply interesting specimen, which was also accompanied by its model, *Planema poggei*, and by a co-mimic, *Elymnias bammakoo*, is figured in the Professor's paper in Trans. Ent. Soc. Lond., 1906, Pl. XVIII, fig. 4, the model in Pl. XXII, fig. 2. The *Elymnias* is figured in Mr. Neave's paper quoted above (Pl. X, fig. 7).

Thirty-three butterflies and one moth from Ambatoharana, Madagascar, 4,900 ft. (1905), were presented by the captor, the Rev. J. U. Yonge, M.A., Keble College. Relatively few insects from Madagascar exist in the Department, and of these hardly any possess adequate data, so that this small collection with accurate localities and dates is of great value. The great majority are catalogued.

An example of the beautiful mimetic butterfly, *Crenidomimas concordia*, from the Johnston Falls, Luapula River, N.E. Rhodesia, was presented by H. Eltringham, Esq., F.E.S. The relation between this butterfly and the common blue species of *Crenis* is one of the most interesting and remarkable of the numerous examples of mimetic resemblance between one Nymphaline genus and another.

A fine series of moths, a few butterflies, insects of other Orders, and one Scorpionid, from Matatiele, Griqualand East, Cape Colony (1905–6), were presented by the captor, E. H. Bazeley, Esq. One hundred and six specimens are catalogued, and many others added to the collection. The data are full and precise, and the peculiarly interesting locality hitherto unrepresented in the Department.

A fine collection of 597 insects of various Orders from many localities in and near Durban, Natal (1902–1906), were pre-

sented by the captor, G. F. Leigh, Esq., F.E.S. This generous gift is the accumulated result of numerous consignments sent by Mr. Leigh during the last few years. It was, however, more convenient to catalogue them as the gift of a single year. The specimens include a number of Hymenopterous and Dipterous parasites bred by Mr. Leigh from the eggs, larvae or pupae of various interesting Lepidoptera. The Diptera include a splendid Asilid fly of the genus *Hyperechia* (probably *H. lateralis*), new to the collection. The data are full and precise, and the whole series constitutes a most valuable accession to the Department. In addition to the above, all of which are catalogued, a few additional specimens have been incorporated. Colonel Bingham has kindly consented to work out the Hymenoptera, together with others in the University Collections from the same part of the world.

A large set of butterflies, some moths, and a few Homoptera from the forests of the Luebo district, Kassai River, 1,345 ft., in the South-west of the Congo Free State, were presented by the Hon. Walter Rothschild, Ph.D., M.P. Of these, 255 specimens are catalogued, and many more incorporated. The collection is of especial interest to the Department on account of the locality, which has been hitherto practically unrepresented. It was of deep interest to find that here some of the best-marked West Coast forms are replaced by those of the South and East. This is the case with *Limnas chrysippus*, among which not a single *alcippus* form was to be seen, the whole of the 136 specimens being typical. *Precis octavia* of the West Coast was also similarly replaced by *natalensis* of the South and East. Characteristic western forms, however, predominate. These include a fine series of *Papilio zalmoxis*, *antimachus*, and *ridleyanus*, together with many of the western species of *Euphaedra*. Examples of the two last-named Papilionids, together with several Acraeas, which they more or less resemble in colours and pattern, were added to the bionomic series.

One hundred and twenty-three Lepidoptera and one Acridian (*Tryxalidae*), from the Kenia Province of British

East Africa (1905–6), were presented by the captors, S. L. Hinde, Esq., and Mrs. Hinde. The majority of specimens were taken or bred at Fort Hall, 4,000 ft., the remainder were captured on the Aberdare Range, 8,000 ft. 74 Lepidoptera and the Acridian were catalogued. The moths include a large number of interesting bred specimens with dates of emergence from the pupa. The butterflies include some interesting forms new to the collection—an *Acraea*, a *Papilio* allied to *nireus*, and a fine *Mylothris*. The locality also adds an interest to the commoner species.

An interesting set of 153 male Pierine butterflies of 8 species, captured (Feb. 2, 1906) in a single sweep of the net, were presented by the captor, C. A. Wiggins, Esq., M.R.C.S. The butterflies were drinking at a small pool at Jinja, by the Ripon Falls, on the N. shore of the Victoria Nyanza, 3,775 ft. Forty-five specimens, including examples of every species, are catalogued, and will be kept together in the collection as a good example of these remarkable congregations of tropical butterflies in damp places. The numbers of individuals of each species were as follows:—

Pinacopteryx vidua, 104
„ *pigea* (N. form of *P. astarte*), 17
„ *liliana*, 5
Belenois formosa, 12
„ *severina*, 5
„ *subeida* (form *instabilis*), 8
„ *gidica*, 1
„ *solilucis*, 1

Examples of all these were exhibited by Dr. F. A. Dixey at the meeting of the Entomological Society of London, June 6, 1906 (*Proceedings*, pp. l, li).

Seven miscellaneous insects (5 catalogued) from Mombasa (Nov. 1904) were presented by the same generous donor.

A series of Lepidoptera and dragon-flies from the neighbourhood of Kisumu, on the N.E. shore of the Victoria Nyanza, 3,770 ft. (1903), were presented by C. A. Wiggins, Esq.,

M.R.C.S. Of these specimens, captured by A. Vincent, Esq., 101 were catalogued, and include some accessions of great interest and value to the Department, such as the three mimetic female forms, *hippocoon*, *trophonius* and *cenea* of *Papilio dardanus* (*merope*), the two last now received for the first time from this locality. Two males and a female of a Papilionid, transitional from *P. rex* to *P. mimeticus*, are also of special interest.

Thirty-five Lepidoptera, chiefly butterflies, and one fine Mutillid (19 catalogued) from various localities in the neighbourhood of Lagos (1906) were presented by the captor, J. A. Cremer, Esq. All the specimens were much wanted by the Department. The butterflies include a perfect specimen of *Pseudacraea hostilia*, a very fine *Euryphene*, and some species of *Euphaedra* new to the collection. Excellent data accompany the specimens.

A valuable series of Lepidoptera, almost entirely butterflies, from the following localities in the neighbourhood of Berbera, Somaliland, were presented by the captor, H. A. Byatt, Esq., B.A., F.E.S., Lincoln College.

From Upper Sheikh, Golis Mountains, 5,000 ft. (Dec., 1905–Jan., 1906), 94 butterflies and 1 moth (36 catalogued and many others incorporated). The butterflies include two specimens of a Satyrine, identified by Mr. H. J. Elwes, F.R.S., as the Palaearctic *Pararge maera*. It was surprising to find this Palaearctic species forming a member of a typically Ethiopian community, and the fact is a deeply interesting example of geographical distribution. Among the Ethiopian species, the most interesting is a series of 8 *Precis octavia*—5 dry-season, 1 intermediate, and 2 wet-season. These specimens are also most remarkable examples of distribution, inasmuch as they approach the tropical West Coast form rather than the Eastern *P. sesamus*.

From Lower Sheikh, Golis foot-hills, 2,800 ft. (Feb., March, 1906), 79 butterflies and 2 moths (21 catalogued and many others incorporated). The specimens include a very fine series of *Acraea chilo*, originally described from Somaliland.

In the examples hitherto in the Department, coming from British East Africa, the black spots are distinctly larger than those of Mr. Byatt's more northern specimens. Several specimens of a Papilionid form belonging to the *nireus* group, and new to the collection, were included in this series, and one in that from Upper Sheikh.

From the summit of the Wagar Mountain, Golis Range, 6,000 ft. (July 1–2, 1906), 22 butterflies (8 catalogued and all incorporated). These include 11 male specimens of *Papilio dardanus* (*merope*) sub-sp. *antinorii*, very greatly wanted by the Department, which is rich in other sub-species and forms of the same intensely interesting butterfly. It is greatly to be hoped that Mr. Byatt may succeed in capturing the female of *antinorii*, the "tailed" mimetic forms of which are only represented in European collections by two specimens, one named *niavoides* by Kheil, and mimicking *Amauris niavius*, the other named *ruspina* by him, and mimicking the type form of *Limnas chrysippus*. Any specimens throwing further light on these astonishing forms would be of the deepest interest to all students of insects, and especially of the problems of mimicry.

Seven types of weevils of the genus *Sciobius*, described in Proc. Zool. Soc. Lond., 1906, viz. *Sciobius cinereus*, *cognatus*, *opalinus*, *barkeri*, *viridis*, *prasinus*, and *horni*, were presented by the author, Guy A. K. Marshall, Esq., F.Z.S., F.E.S., together with five named specimens of the same genus from S. Africa. In the same paper, Mr. Marshall described a new species from the Tylden Collection in the Department, *S. cultratus*, and one from the Hope Collection, *S. obesus*. He also very kindly named the specimens of the genus in the University Collection.

The following fine accessions to many parts of the general collections are also due to the kindness of the same generous donor, who has done so much for the Department during the past ten years:—

Eight hundred and ninety-seven insects of many Orders, from the neighbourhood of Salisbury, Rhodesia, 5,000 ft.

(1899–1906, but chiefly in the years 1905 and 1906). In addition to these a relatively small number of uncatalogued specimens have been incorporated. The series contains 21 Asilid flies, collected with great care, and a valuable addition to the general collection of this most interesting group. One hundred and fifty-four catalogued specimens of Aculeate Hymenoptera, 288 of Coleoptera, 177 of Rhynchota, and 204 of Orthoptera—all of them with Mr. Guy Marshall's admirable data—are a valuable accession to the collections of these Orders of insects. In addition to the above, Mr. Marshall presented 6 sets of the wings of *Precis sesamus* (Salisbury, 1905), dissected out of the pupal case. The specimens are of great interest in showing an early stage of development of the pigment.

Five hundred and seventy-five catalogued (and relatively few uncatalogued) specimens of insects of many Orders, from the Chirinda Forest, Melsetter, Gazaland, S.E. Rhodesia, 3,600–4,000 ft. (Sept.-Oct., 1905). Of these no less than 329 are Hymenoptera, other Orders being represented by relatively small numbers. Two beautiful Dipterous mimics of Aculeate Hymenoptera are included, together with their respective models, captured upon the same dates.

Thirty-two Lepidoptera and dragon-flies from Mazoe, Mashonaland, 4,000 ft. (Dec., 1905). These include many *Lycaenidae*, greatly wanted by the Department, and several specimens which offer convincing indirect evidence of the attacks of enemies.

Small mixed collections of insects, chiefly Orthoptera, from the following localities in S.E. Rhodesia (1905):—Mangesi River, Manica, 3,000 ft. (Oct.); Mpudzi River, Manica, 3,000 ft. (Oct.); Mpudzi River to Amanzimhlope River, 3,000 ft. (Sept.); Inyanyadsi River, Manica, 2,500 ft. (Sept.); Mahakata River, Gazaland, 5,000 ft. (Oct.); Upper Buzi River, Gazaland, 3,500 ft. (Sept.); Umvumvumvu River, Gazaland (Sept.). The elevations are approximate. Altogether 270 specimens from these localities are catalogued, in addition to a considerable number, chiefly Orthoptera, uncatalogued.

One hundred and fifty-three catalogued insects of several Orders, chiefly Orthoptera, in addition to a few unnumbered, from Umtali, S.E. Rhodesia, 3,700 ft. (Dec., 1901, and Sept., Oct., 1905).

Three *Mutillidae*, including a pair captured *in coitu*, from Bulawayo (Dec., 1903), and 3 miscellaneous insects from Beira, captured in 1905 by A. Sadong, Esq.

Three Hymenoptera Aculeata from Estcourt, Natal, 4,000 ft. (Oct., 1902).

Twenty-nine Coleoptera (16 catalogued) from Wynberg, near Cape Town (Nov., 1904).

From the above splendid list of accessions it will at once appear that Mr. G. A. K. Marshall's donations in 1906 have been upon the same generous scale as in former years.

A series of Lepidoptera, from Ibadan, near Lagos (Dec. 1906), unfortunately much injured by insect pests, was presented by H. S. Gladstone, Esq. It was only possible to catalogue 12 specimens. The injury was not altogether fruitless; for it was observed that in two cases the scent-gland on the hind wing of a male Danaine butterfly (*Limnas chrysippus* and *Amauris egialea*) had been devoured, while the rest of the wing was untouched. The specimens were exhibited at the Entomological Society of London on March 6, 1907 (see *Proceedings* for this date).

A set of 38 butterflies and 4 dragon-flies from Aro-Chuku, Calabar, and from the road between Nde' Liche and Cross River, Calabar (all Aug., 1906), was presented by the same kind donor. These too were unfortunately terribly injured by pests, so that it was impossible to catalogue any of them. This is all the more to be regretted, as many of the species were greatly wanted by the Department. All possible care and skill was devoted to repairing the specimens, and many have been added to the collections. The series of butterflies includes some beautiful examples of mimicry, which have been added to that special section of the collections. These include a fine *Pseudacraea*, together with two of its *Planema* models; also *Amauris niavius*, with a mimetic *Euralia* and

Elymnias. The degree of coincidence in time and space between these models and mimics renders them of special interest.

Purchases in 1906.

A female of *Papilio dardanus* (*merope*), sub-sp. *cenea* ♀ f. *hippocoon*, with the 28 offspring bred from its eggs, was purchased from Mr. G. F. Leigh of Durban. The results are more complete than any yet attained; for the offspring include 14 of the non-mimetic males, 3 *hippocoon* females like the female parent, mimicking *Amauris niavius*, f. *dominicanus*, 3 *trophonius* females mimicking *Limnas chrysippus*, 3 *cenea* females with white spots in the fore wing mimicking *Amaüris àbimaculata*, and 5 *cenea* females with buff spots in the fore wing like a common form of *Amauris echeria.* It is hoped that an account of this most interesting series of specimens will be published and illustrated at no distant date.

Additions to the British Collections in 1906.

The following *Blattidae*, which had accidentally reached this country in foreign fruit or in plants, have been added to the collection :—

One *Nauphoeta brazzae*, found at Kew in plants from the Congo Free State (1898), presented by W. J. Lucas, Esq., B.A., F.E.S.

One *Blabera cubensis*, found on bananas in the Woodstock Road, Oxford (Sept., 1906), presented by H. Smart.

One *Blabera cubensis*, found on a fish slab in the Oxford Market (Aug., 1906), presented by H. Paddon.

Two *Panchlora virescens*, found on bananas at Warrington (Aug., 1906), presented by Mr. Joseph Collins.

Ten specimens, examples of *Ectobia livida*, *panzeri*, and *lapponica*, from various localities in the South of England (1898-9), were presented by the captor, W. J. Ashdown, Esq. The specimens are accompanied by excellent data.

A fine set of *Ectobia livida* (of which 8 are catalogued) from

Dawlish (July, 1906), were presented by the captor, Mr. A. H. Hamm.

One *Ectobia panzeri*, taken at St. Helens, Isle of Wight (Aug., 1906), was presented by the captor, Mr. W. Holland.

One larval *Ectobia livida*, taken at Horsell, near Woking, was presented by the captor, Commander J. J. Walker, R.N., Hon. M.A., F.E.S.

Five *Ectobia lapponica*, from the New Forest (1905), were presented by the captor, Commander J. J. Walker. Of these specimens 2 have been added to the British, 3 to the general collection.

Eight examples of the beetle, *Laemosthenes complanatus*, recently added to the British list (Ent. Monthly Mag., 1902, p. 216), from Queenborough, Kent (Aug., 1906), were presented by the captor, Commander J. J. Walker. Of these 7 have been catalogued.

An example of Fossorial Hymenopteron, *Oxybelus uniglumis*, with its Dipterous prey, *Lasiops* sp. (?) *ctenoctema*, ♂, from Chobham, Surrey (July, 1906), was presented by the captor, Rev. F. D. Morice, M.A., Queen's College, Oxford.

A useful set of Lepidoptera from the North of England (1900–4) were presented by the captor, H. A. Beadle, Esq. Sixty specimens (34 catalogued) were from Keswick, 1 from Witherslack, N. Lancashire, and 5 (examples of *Agrotis suffusa* and *A. saucia*) from the Isle of Man. The Hope Collections are weak in specimens from this part of the British Islands, and the collection is correspondingly valuable.

Six Diptera from Dunmall, Co. Waterford (Aug., 1906), were presented by the captor, R. Shelford, Esq., M.A., F.L.S., F.E.S.

An example of the Saw-fly, *Tenthredo livida* ♀, devouring the female of another species of Saw-fly, *Strongylogaster cingulatus*, was presented by the captor, Col. J. W. Yerbury, F.L.S., F.E.S. The specimens were taken at Porthcawl, S. Wales (June, 1906).

One hundred and thirty-seven Coleoptera from Porthcawl, S. Wales (May–July, 1906), 1 from Nairn (Aug., 1905), and

1 from Studland, Dorset (Aug., 1906), were presented by the captor, Col. J. W. Yerbury.

A set of British insects of various Orders, chiefly Coleoptera, from Mortehoe, N. Devon (1906), and a few from Streatley (July, 1906), were presented by the captor, G. B. Longstaff, Esq., D.M., New College. 138 specimens were catalogued for a permanent place in the collection, and many others added. The series includes a set of bees and their Dipterous mimics, captured on the same day, Aug. 17, 1906, at Mortehoe.

In addition to the above, Dr. Longstaff presented 2 female specimens of the Asilid fly, *Philonicus albiceps*, from the Woolacombe sand-hills, N. Devon, one (Aug. 24, 1906) devouring a fly of the genus *Sarcophaga*, probably *S. carnaria*, the other (Sept. 25, 1906) the Syrphid fly, *S. corollae.*

Eleven hundred and sixty-nine insects with admirable data were presented by H. St. J. K. Donisthorpe, Esq., F.Z.S., F.E.S. Of these no less than 1,050 specimens are accessions to the collection of British Coleoptera. The remainder consist of Hymenoptera, Rhynchota, a few insects of other Orders, and additions to the bionomic series. The latter includes a set of 13 yellow-banded Hymenoptera, Diptera and Coleoptera captured together on meadow-sweet at Matley Bog, New Forest (July 6, 1905), and a similar group of 15 Hymenoptera and Diptera taken together on hog-weed at Battle, near Hastings (Aug. 6, 1905). Another interesting accession to the bionomic series is a specimen of the beetle *Cassida viridis* with a piece taken out of the left elytron, probably the work of an enemy. The specimen was captured at Micklesham, Surrey (May 29, 1905). The donation also includes an example of the Phytophagous beetle, *Timarcha violaceo-nigra*, of which the second leg on the left side had been removed, probably by an enemy. The specimen was taken at Deal (April, 1906).

The Hope Library.

Miss Bellamy had made considerable progress with the card catalogue when, under doctor's orders in the autumn,

the work had to be temporarily stopped. Miss Shelford has now kindly undertaken to continue this much-needed work until Miss Bellamy is able again to undertake it.

The portion of the card catalogue already completed is of the greatest value, and is continually consulted.

A certain amount of binding has been done, but almost exclusively of accessions, and practically nothing to overtake the vast arrears. A considerable sum of money ought to be spent in securing the older part of the Library from injury.

A very interesting and somewhat amusing letter from the founder of the Hope Chair was found among the correspondence of the late Rev. H. Adair Pickard, M.A., Christ Church, and kindly presented to the Hope Department by Mrs. Adair Pickard. It was written Feb. 27, 1857, from Nice, to the President of the "Oxford University Entomological Society," the Rev. H. Adair Pickard.

Two minute books of the "Oxford University Entomological Society" exist in the Hope Department Library. The meeting first recorded is dated June 1, 185[8]. An injury to the page has obliterated the fourth figure of the year, but as the next meeting was held Nov. 2, 1858, there can be no reasonable doubt about the date. Inasmuch as "the minutes of the last meeting" were read and confirmed on June 1st, it is evident that earlier minutes at one time existed. The Society continued to exist as late as 1872, when the last unconfirmed minutes appear under the date May 2. Professor Westwood had then been President for many years. "After some conversation about the prospects of the Society and summer excursions, the meeting adjourned," and apparently never re-assembled.

The circumstances under which the Entomological Society of Stockholm presented its Entomologisk Tidskrift up to date, together with arrears from 1893, and the German Entomological Society its Deutsche Entomologische Zeitschrift, for the same period, have already been explained.

The Boston Society of Natural History and the Bombay

Natural History Society presented their publications for the year 1906.

The volumes of the "Novitates Zoologicae" of the Tring Zoological Museum, published in the year 1906, were presented by the Hon. Walter Rothschild, Ph.D., M.P.

The publications of the Société Entomologique de France for 1906, and of the Société Entomologique de Belgique for 1906, together with the Jubilee number of the Memoires, the publications of the Linnean Society for 1906, and the Transactions of the Entomological Society of London for 1906 were presented by the Professor, and a bound second set of the latter for 1905 by G. A. James Rothney, Esq., F.E.S., in continuation of his generous gift in 1904.

The following Reports, &c., were presented:—

Bristol University College: Report of Council for 1903–4.

Cambridge University: Fortieth Annual Report, for 1905, of the Museum and Lecture-rooms Syndicate. Papers on the collections of Arthropoda made by the Skeat Expedition to the Malay Peninsula, by N. Annandale, P. Cameron, F. F. Laidlaw, W. F. Lanchester, E. Simon, and F. G. Sinclair, were presented by the Superintendent of the University Museum of Zoology, Cambridge.

Cornell University: College of Agriculture, Bulletins 233–5, by M. V. Slingerland, Esq.

Ottawa: Report of Government Experimental Farms for 1903–4, including the Director's Report of Central Experimental Farm, Ottawa, and of the Canadian Department of Agriculture: also two memoirs by the Director, Dr. W. Saunders.

Owens College: The Report of the Manchester Museum for 1905–6.

The Radcliffe Library: The Catalogue of Books added to the Library, 1905.

Sarawak Museum: The Report for 1905.

Agricultural Experimental Stations of the Colorado Agric. Coll. (Bull. 94, 1904), and of Fort Collins, Colorado (Bulletins 20, 21, 1903–4).

Otago University Museum: Report for 1905-6.

Indian Museum, Calcutta: Report for 1905-6.

Cairo Zoological Gardens: Report on Mission to Europe, 1906.

Marine Biological Association for the West of Scotland: Report for 1905.

Kew Bulletin: The wild fauna and flora of the Botanic Gardens, 1906.

Ashmolean Natural History Society: Report for 1905.

Rhynchota, vols. ii (2 parts) and iii, by W. L. Distant, F.E.S., and Cerambycidae, vol. i, by C. J. Gahan, M.A., F.E.S., both of the Fauna of British India Series, were presented by the Secretary of State for India in Council.

Fasciculi Malayenses: Zoology, Pt. III, was presented by the editors, Dr. Nelson Annandale, D.Sc. Edinb., B.A., Balliol College, and H. C. Robinson, Esq.

The Trustees of the British Museum presented a Synonymic Catalogue of Homoptera, Pt. I, Cicadidae, by W. L. Distant, F.E.S.

The Director of the Cold Spring Harbor Station for Experimental Evolution, Dr. C. B. Davenport, presented the Report for 1906, and three memoirs by himself and one by H. E. Walter, Esq.

Mem. Soc. Espan. Hist. Nat., parts of vols. i-iii, and Bol. Soc. Espan. Hist. Nat., parts of vols. iv and v, were presented by Malcolm Burr, Esq., B.A., F.G.S., F.L.S., F.E.S., New College.

Rend. R. Accad. Sci. Istit. Bologna, Fasc. 1-4, vol. ix (1904-5). Mem. R. Accad. Sci. Istit. Bologna, Ser. VI, vol. ii. Presented by Sir John Evans, K.C.B., Hon. D.C.L., F.R.S.

The "Naturalist's Monthly," vol. i, nos. 1-6, 1887, was presented by J. L. Myres, M.A., Christ Church.

Smithsonian Institution (United States National Museum) Report for 1904-6. Part 2 of the 1886 Report was presented by the University Observatory, thus filling a gap in the Department series.

The Smithsonian Institution (United States National

Museum, Washington) also presented valuable memoirs by the following writers:—James A. G. Rehn, Esq. (four memoirs); Miss Harriet Richardson; August Busck, Esq.; E. A. Klages, Esq.; Alexander D. MacGillivray, Esq.; A. M. Banta, Esq. and W. L. McAtee, Esq.; W. Schaus, Esq., F.Z.S.. F.E.S.; W. H. Ashmead, Esq.; A. N. Caudell, Esq.; W. Warren, Esq.; L. Bruner, Esq.; A. E. Ortmann, Esq. In addition to the above memoirs the Smithsonian Institution presented the valuable Catalogue of North American Diptera, by J. M. Aldrich, Esq.

The following fifteen authors have kindly presented long series of their valuable publications to the Hope Library:—

Eight memoirs (one in conjunction with P. C. Wroughton, Esq.) were presented by Nelson Annandale, Esq., D.Sc. Edinburgh, B.A., Balliol College, Deputy Superintendent of the Indian Museum, Calcutta.

Twelve memoirs on Lepidoptera were presented by George T. Bethune-Baker, Esq., F.L.S., F.E.S.

Twenty-six memoirs on Coleoptera, chiefly *Lucanidae* (one in conjunction with Monsieur Ch. Alluard) were presented by Monsieur H. Boileau.

Nine memoirs upon the Malacoderm Coleoptera were presented by Monsieur Jules Bourgeois.

Eighteen memoirs upon Orthoptera were presented by Señor Don Ignacio Bolivar.

Fifteen memoirs upon Orthoptera were presented by Malcolm Burr, Esq., B.A., F.G.S., F.L.S., F.E.S.

Ten memoirs upon Hymenoptera were presented by Monsieur le Vicomte R. du Buysson, together with memoirs on the same Order by Rev. T. A. Marshall, Dr. T. D. A. Cockerell, Monsieur J. Vachal, Monsieur Ernest André, Pastor F. W. Konow and Monsieur J. Perez.

Twenty-eight memoirs on Orthoptera (one in conjunction with Dr. Harrison G. Dyar) were presented by Dr. A. N. Caudell, of Washington.

Fifty-seven memoirs were presented by Dr. T. A. Chapman, D.M., F.Z.S., F.E.S.

Twenty-two memoirs on Orthoptera were presented by Dr. Achille Griffini, of Genoa.

Nine memoirs upon Coleoptera (*Bostrychidae*) were presented by Monsieur P. Lesne, of Paris.

Thirty-eight memoirs on Orthoptera (two in conjunction with M. Hebard) were presented by J. A. Rehn, Esq., of Philadelphia.

Fifteen memoirs on Australian insects, chiefly Orthoptera, were presented by J. G. O. Tepper, Esq., F.L.S., of Adelaide.

Eight memoirs on Orthoptera were presented by Dr. E. Giglio-Tos, of Florence.

Eight papers on ants were presented by Professor W. Morton Wheeler, of the American Museum of Natural History, New York.

Miss J. Buckton presented original drawings of the *Membracidae* by her father, the late Dr. G. B. Buckton, F.R.S., together with one memoir by him.

Memoirs by Professor E. S. Morse, G. C. Champion, Esq., and Dr. T. A. Chapman were presented by the Professor.

A memoir by Roland Trimen, Esq., F.R.S., &c., on South African butterflies collected by the donor, was presented by F. C. Selous, Esq.

The Dynamics of Living Matter, Columbia University Biological Series, by Professor Jacques Loeb, was presented by the author.

The fine monograph, Biologische Untersuchungen in Transkaspien, St. Petersburg, 1906, was presented by the author, Dr. V. Faussek.

The Source of the Blue Nile, London, 1905, was presented by the author, A. J. Hayes, Esq., L.S.A., of Suez.

The Lepidoptera of Dorsetshire, 1886, by the late C. W. Dale, was presented by Commander J. J. Walker, together with two of his own memoirs.

The valuable monograph, Spolia Hymenopterologica, Paderborn, 1906, was presented by the author, Dr. Albert Schulz, together with three memoirs on *Trigonalidae*.

A memoir on the *Tettigidae* of Ceylon, by Dr. J. L.

Hancock, M.D., of Chicago, was presented by the Colombo Museum, Ceylon.

An important monograph on the Chelonethi of Siam, Copenhagen, 1906, was presented by the author, Dr. C. J. With, of Copenhagen.

The Butterfly Hunters in the Carribees, by E. Murray-Aaron, was presented by Dr. G. B. Longstaff, D.M., New College, together with a memoir by A. Pictet, Esq.

Professor R. Meldola, F.R.S., presented four volumes of separata on Insects. The great majority of these are now old and extremely difficult or even impossible to get, so that the gift is of the utmost value to the Library.

Colonel J. W. Yerbury, F.L.S., F.E.S., presented a volume of separata on Oriental Insects, chiefly Lepidoptera, by various authors, together with Butterflies of India, by Marshall and de Nicéville, vols. i and ii. The same kind donor had presented the third volume at an earlier date.

The Catalogue of Anthribidae, by Monsieur A. Boire, of Brussels, was presented by Dr. Karl Jordan.

The great increase in the literature of Orthoptera in the Department Library is due to the researches and the special efforts of R. Shelford, Esq., M.A., Emmanuel College, Cambridge, F.L.S., F.E.S. The knowledge of the work going on in the Department, and the receipt of separata of Mr. Shelford's researches, together with his letters, have combined to produce the donations of literature dealing with the Orthoptera, acknowledged in this Report. In addition to this valuable help, Mr. Shelford has presented two of his own papers, together with memoirs on various insect Orders and insect economics by the following authors:—Dr. Y. Sjöstedt, of Stockholm; Herr F. Meunier, of Brussels; A. D. Hopkins, Esq.; W. E. Hinds, Esq.; L. J. Webb, Esq.; C. Stål (five memoirs); Dr. C. F. Adams (two memoirs); A. F. Burgess, Esq.

Original papers have also been presented by the following authors: Dr. N. v. Adelung, of St. Petersburg (three memoirs); H. G. Barber, Esq.; Professor T. Hudson Beare, B.Sc., F.R.S.E., F.E.S. (two memoirs); H. Rowland-Brown, Esq., M.A.,

F.E S, University College; Merritt Cary, Esq.; Mabel Colcord; F. J. Cole, Esq., B.Sc., Jesus College; Professor Arthur Dendy, F.L.S.; Monsieur Jules Desneux; F. P. Dodd, Esq., F.E.S.; H. St. J. K. Donisthorpe, Esq., F.Z.S., F.E.S.; Hamilton H. Druce, Esq., F.Z.S., F.E.S.; Herbert Druce, Esq, F.L.S., F.Z.S., F.E.S. (three memoirs); Dr. Harrison G. Dyar, of Washington; H. F. Fernald, Esq.; Philip B. Hadley, Esq. (two memoirs); Miss Ruth Harrison, Lady Margaret Hall, Oxford; Herbert E Walter, Esq.; Dr. Walther Horn, D.M., of Berlin (three memoirs); Dr. L. O. Howard, of Washington (two memoirs); Dr. W. E. Hoyle, M.A., D.Sc., Christ Church; Martin Jacoby, Esq., F.E.S.; Guy A. K. Marshall, Esq., F.Z.S., F.E S. (two copies of his memoir in P. Z. S., 1906); W. S. Marshall, Esq. (three memoirs, one in conjunction with P. H. Dernehl and one with C. T. Vorhies); Isabel McCracken; F. Merrifield, Esq., F.E.S.; Professor E. A. Minchin, M.A., Keble College (in conjunction with Lieut. Gray and Lieut. F. Tulloch, R.A.M.C.); G. T. Porritt, Esq., F.L.S., F.E.S.; J. G. Sanders, Esq., of Washington; Edward Saunders, Esq., F.R.S., F.L.S., F.E.S.; C. Schaeffer, Esq.; Dr. Seidlitz; Miss E. M. Sharpe; A. E. Shipley, Esq., M.A., F.R.S., F.Z.S., Christ's College, Cambridge (two memoirs); E. J. B. Sopp, Esq., F.R.Met.S., F.E.S.; R. S. Standen, Esq., F.L.S., F.E.S.; Rev. T. R. R. Stebbing, M.A., F.R.S., F.L.S., Worcester College (two memoirs); Mark L. Sykes, Esq.; Dr. K. Toyama (two memoirs); Roland Trimen, Esq., Hon. M.A., F.R.S., F.L.S., F.E.S. (two memoirs); Lieut. F. Tulloch, R.A.M.C.; G. H. Verrall, Esq., F.E.S.

Purchases.

The following publications of the year 1906 were purchased for the Department:—The parts of Barrett's "British Lepidoptera," the Ray Society volume, the volume of the Zoological Record, the numbers of the "Entomologist's Monthly Magazine," the "Entomologist," and the "Entomologist's Record."

In addition to the above—the normal expenditure for many

years—the following purchases were made:—C. Brunner von Wattenwyl, "Neue Phaneropteriden," 1878; "Prodromus der Europäischen Orthopteren," 1882; "Système de Gryllides;" "Revision du Système des Orthoptères et description d'esp. rapportées, par M. Léonard Féa," 1893; "On the Orthoptera of the Sandwich Islands," 1895; "On the Orthoptera of the Island of Grenada, West Indies," 1893; Brunner von Wattenwyl and Prof. J. Redtenbacher; "On the Orthoptera of the Island of St. Vincent, W. Indies," 1892. H. Borg, "Blattodeen aus Kamerun," 1902; Henri de Saussure, "Revision de la tribu des Hétérogamiens orthoptères de la fam. de Blattides," 1893; "Revision des Panesthiens et de celle des Epilampriens orthop. de la fam. de Blattides," 1895; L. Fairmaire, "Coléoptères," Hist. Nat. France, Pt. 8; A. de Bormans and H. Krauss, "Forficulidae and Hemimeridae;" F. Lowe, "Catalogue of Lepidoptera," vol. i, Pt. I, 1904.

E. B. POULTON.

Report of the Hope Professor of Zoology, 1907.

The donations described in the later pages of this Report, and the work recorded in its earlier part, show that the year 1907 was a very active one. The necessity for increased space becomes more pressing with each fresh donation received and each rearrangement effected.

It has been a great pleasure to welcome the return of Mr. Roland Trimen, Hon. M.A., F.R.S., to Oxford. The University Collections are now so rich in Ethiopian butter-

flies that his unique knowledge will be of the greatest assistance in the attempt to solve the most difficult problems presented by this deeply interesting zoological province.

1. *Lectures on Bionomics as part of the Honours Course for the Final Examination in Zoology.*

Professor G. C. Bourne suggested that the Hope Professor should take part in the teaching for the Final Honours Examination in Zoology by delivering a short course of lectures illustrated by examples from the Hope Collections. The first course was given to the Honour students in the Summer Term of last year. It is hoped that when the second is delivered in the summer of 1909, the difficulties due to want of space may have been overcome. It has been a great pleasure to show and explain the bionomic collections, which are much studied by non-resident naturalists and by a few Oxford investigators, to the Honour students in Zoology, and to know that the subject, which can be better studied here than in any other centre, will now take its place as part of the Honours Course.

2. *Financial Gifts and Grants to the Department.*

The sum of £178 10*s.* was spent on cabinets during the year, a set of ten cabinets containing 200 interchangeable drawers of the Department pattern being received, and improvements effected in the drawers of an old type of cabinet. Another set of ten similar cabinets is in course of construction. Towards the expense of cabinets the Department received during the year £100 from the Common University Fund and £100 from the Professor. The latter also contributed £40 for expenses upon the collection of *Pierinae*, while Dr. G. B. Longstaff generously renewed the valuable grant for defraying the expense of an extra assistant.

3. *Work done by the Staff.*

Mr. Shelford's work on the Orthoptera and Dr. Dixey's on the *Pierinae* are described in the following sections. An account of Commander Walker's kind help is given in Section 6.

Mr. Holland's time was principally occupied during the past year upon the large collection of Coleoptera. Several groups of this important collection have been arranged by him in the cabinets purchased from the trustees of the late Mr. Alexander Fry. All the specimens belonging to these groups in the Miers Collection, together with the whole Tylden Collection of *Curculionidae*, have received printed labels with the fullest ascertainable data, and have been added to the General Collection. The specialist can now study this material in one comprehensive collection, in which the specimens are so arranged that they can be examined and moved without danger to themselves or those around them. Omitting smaller groups, the *Scarabaeidae* have been arranged in 180 drawers, the Heteromera in 81, the *Curculionidae* in 102, the *Elateridae* in 24, the Malacoderms in 24, the *Cleridae* in 10. In addition to the above, the *Anthribidae*, arranged in genera and in large part specifically named by Dr. Karl Jordan of the Tring Zoological Museum, have been arranged by Mr. Holland in 13 drawers. Dr. Jordan's determinations have been printed or written and affixed to each individual specimen by Mr. J. Collins, who also undertook the labelling of the Miers and Tylden Coleoptera.

Mr. A. H. Hamm has been chiefly occupied with the large collection of insects made in South Africa, &c., in 1905 by Dr. G. B. Longstaff, Dr. F. A. Dixey, the Professor, and many others. A full account of this great accession will be found in the account of the 1905 accessions in the later pages of this Report. Much of Mr. Hamm's time was also spent in setting, and printing labels for Dr. G. B. Longstaff's West Indian and South American collections made in 1906 and 1907, and in resetting the old specimens in the General Collection of butterflies. Mr. Hamm also devoted considerable attention to the British Diptera and also to certain sections of the General Collection of this Order.

In addition to work upon the Coleoptera arranged by Mr. Holland, Mr. J. Collins arranged nearly the whole of the *Carabidae* of the British Collection, and labelled and in large part printed labels for the accessions acknowledged in this

Report. By far the largest separate piece of work was that involved in labelling Mrs. Bazett's great collection of nearly 7,000 British Micro-lepidoptera.

4. *Work on the Collections of Orthoptera.*

The following report has been written by Mr. R. Shelford, M.A., F.L.S., F.E.S. :—

Work on the collection of *Blattidae* has been continued steadily throughout the year, and has resulted in the preparation of eight memoirs, some of which are still in the press. Those which appeared in 1907 will be found in the list of published papers in Section 10. As a consequence of the growing importance of the collection of *Blattidae* in this Museum, applications for assistance in determining the collections of these insects in other Museums are continually being received, and collections have been sent for identification from the following Museums :—Brussels, Berlin, Deutsche Entomologische National Museum (Berlin), Genoa, Hamburg, Madrid, Melbourne, Paris, Stockholm, and Wiesbaden. As duplicates from collections sent for determination are invariably presented to this Museum in return for the labour expended on working them out, the increase in size and importance of the Hope Collection of *Blattidae* is bound to become very considerable in a comparatively short period of time. To take one example, Dr. Sjöstedt, of Stockholm, presented from the collection made by him on Mount Kilimanjaro over 50 specimens representing 17 species and including 8 co-types; other important additions are noted in another part of this Report. Considerable attention has been paid to the accurate determination of the species represented in the Hope Collection, and for this purpose type specimens have been borrowed from other Museums. Professor Baldwin Spencer, F.R.S., of Melbourne, Dr. Carl, of Geneva, Dr. R. Gestro, of Genoa, and Dr. G. W. Müller, of Greifswald, have been extremely obliging in the matter of lending types for purposes of study and comparison, whilst Dr. Kuhlgatz, of Berlin, and Dr. Holdhaus, of Vienna, have been most courteous in rendering all assistance possible by kindly comparing specimens with types too fragile or

too precious for transmission by post. A visit was paid in September to Denmark and Sweden in order to study the collections of De Geer, Thunberg, Fabricius, and Stål in the Copenhagen, Stockholm, and Upsala Museums. A memoir on the *Blattidae* in these classic collections is now in the press.

A few species of *Blattidae* in the collection of the British Museum were determined and the new species described; co-types of 4 species being presented to the Hope Collection. The co-types of 7 new species were presented by the Paris Museum.

Dr. R. Klebs, of Königsberg, has sent for determination a large collection of cockroaches enclosed in amber, from the celebrated deposits of Lower Oligocene age in Eastern Prussia. Very little has been written on the insect fauna of this geological period since the appearance of Berendt's and Germar's great memoir *Die Bernsteinfauna* in 1845. Dr. Klebs' collection shows that considerable additions must be made to the list of Oligocene *Blattidae*; and a comparison between the recent and the fossil genera is bound to yield results of considerable interest. A memoir on the group is now in course of preparation, and Dr. Klebs has kindly promised to present duplicates to the Hope Collection.

The appearance of two parts of the long-expected memoir on the *Phasmidae*, by the veteran orthopterist, Hofrath C. Brunner von Wattenwyl and Dr. Jos. Redtenbacher, enabled a much-needed rearrangement of the Hope Collection of these insects to be commenced. One of the two sections into which the family is divided, *Phasmidae Areolatae*, has now been arranged. It occupies 27 cabinet drawers and comprises 467 specimens, representing 53 genera and 133 species, and including 39 types. As the late Professor Westwood devoted much attention to this family of insects, the Hope Collection is an extremely important and valuable one. It is hoped that the rest of the *Phasmidae* will be in order by the end of 1908.

Dr. J. L. Hancock, of Chicago, returned during the course of the year the *Tetriginae* entrusted to him for determination.

The entire collection of these obscure little grasshoppers has now been arranged, and occupies 9 cabinet drawers: it comprises 835 specimens, representing 52 genera and 176 species: there are 35 type-specimens. A certain proportion of the species still await identification and will shortly be sent to Dr. Hancock.

5. *Work on the Collection of Pierinae.*

Dr. F. A. Dixey completed the working out of the material resulting from Mr. G. A. K. Marshall's experiments on the effect of artificial conditions on seasonally dimorphic species. The final results were communicated to the Entomological Society of London on Feb. 6, 1907. He also devoted much attention to the subject of mimicry, partly with a view to the Evening Discourse delivered by him before the British Association at the Leicester Meeting in August (published in *Nature*, vol. lxxvi, 1907, p. 673). The mimetic relations of African Pierines formed a special object of study, and were investigated in connexion with the seasonal and geographical variation shown by the forms concerned. Exhibits were prepared to illustrate many of the results arrived at; some of these were shown at the Royal Society's Conversaziones in the summer of 1907, and at the Meeting of the British Association at Leicester. A part of these and other exhibits will remain, permanently arranged as at present, in the Hope Department. The work of incorporating accessions to the General Collection of Pierines was kept up to date, and progress was made in the preparation of a treatise which will deal comprehensively with the whole of this group.

6. *Rearrangement of the British Beetles.*

Early in the year the first great section of the British Coleoptera, the Geodephaga (*Carabidae* and their allies) or ground-beetles, had been prepared for rearrangement by the kindness of Commander J. J. Walker, and by Mr. J. Collins working under his direction. The older specimens had been cleaned and remounted, all old labels being carefully preserved and copied, when in the previous arrangement a single label applied to more than one example. The recent acces-

sions, especially the fine series of specimens presented by Mr. H. St. J. Donisthorpe, had been incorporated, and the whole provisionally classified. It was felt, therefore, that the time had come for a new and careful arrangement to be made in fresh drawers, and for the addition of the specimens of the splendid British collection of Coleoptera so generously presented by Mr. W. Holland. These, chiefly presented in 1901, have all been supplied with printed labels by Mr. Holland. They form a collection three times as large as the original Westwood Collection, together with all other additions made to it up to the present time. The rearrangement has been carried out, nearly as far as the end of the *Carabidae*, by Mr. J. Collins. It occupies at present 30 drawers, containing about 4,400 specimens.

Commander Walker is now continuing his kind help with the succeeding groups. The *Dytiscidae*, nearly finished in 1907, are now ready for rearrangement, while work upon the *Hydrophilidae* is far advanced.

7. *Work upon the Burchell Collections.*

Mr. J. C. Moulton, of Magdalen College, worked during a large part of the past year upon the Brazilian butterflies collected in 1825–30 by W. J. Burchell. Kind help in the description of new forms was afforded by Mr. Roland Trimen, F.R.S. Colonel D. Prain, F.R.S., Director of the Royal Gardens, has also courteously aided the work by permitting the Professor to study in Oxford the volumes of Burchell manuscript in the Herbarium Library at Kew.

8. *Assistance in working out the Material of the Department.*

Colonel J. W. Yerbury with great kindness came to Oxford in the Lent Term and worked at the collection of *Asilidae*, incorporating the accessions and in some cases revising the previous arrangement. He then arranged the *Diopsidae*, a peculiar and interesting group of flies much studied by Professor Westwood. The material is now in beautiful order, and the types verified and clearly labelled.

Dr. F. D. Godman, D.C.L., F.R.S., rendered the Department great assistance by naming the whole of the American *Hesperidae*, which were taken to London and reset in order to facilitate the manipulation. All of the specimens have now been returned, and the determinations affixed to every one. The whole of the Old World *Hesperidae* were similarly taken to London and left with Mr. Hamilton H. Druce, F.L.S., F.E.S., who is kindly working them out, as he did the *Lycaenidae* of the University Collection. The complete arrangement of the former group, containing so many obscure and difficult forms, cannot be far distant, and will be of the utmost value.

Mr. W. J. Kaye, F.E.S., kindly came to Oxford for a few days at the beginning of the Summer Term, and named the whole of the *Heliconinae*, a group of difficult South American butterflies, of which he has recently made a special study. His determinations have been affixed to all the specimens, and the rearrangement of the sub-family is now a comparatively simple task which will soon be accomplished.

Among the Coleoptera large numbers of specimens have been taken to London, and have been very kindly determined by distinguished authorities in the groups to which they belonged:—*Cetoniidae*, by Mr. O. E. Janson, F.E.S.; *Passalidae*, by Mr. G. J. Arrow, F.E.S.; *Anthribidae* (at the Tring Zoological Museum), by Dr. Karl Jordan, F.E.S.

In the spring an opportunity arose for bringing by hand from Paris a further consignment of Malacoderm Coleoptera, named by the distinguished authority of the group, Monsieur Jules Bourgeois, of Ste Marie-aux-Mines, Alsace. Monsieur Octave Bourgeois most courteously offered the kindest help in carrying by hand to the Paris address the specimens he had received from his brother. The consignment reached Oxford in perfect safety, and the determinations are now affixed to all the specimens.

In addition to the kindest help in many directions, Mr. Guy A. K. Marshall, F.Z.S., F.E.S., has named a large number of *Buprestidae* by comparison with the fine collection in the British Museum. Furthermore, Mr. Marshall, continuing his

important series of papers on the African *Curculionidae*, has examined and determined the species of another group in the University Collection. In this material he found and described a new species, *Synthocus damarensis*, and a new variety, *bicuspis*, of another species, *Synthocus wardeni*, Pér. The descriptions are published in *Trans. S. Afr. Phil. Soc.*, 1907, vol. xviii, pp. 96 and 106 respectively.

Much kind assistance has also been rendered in the Hymenoptera. A large number of wasps (Diploptera), taken to Paris by Mr. R. Shelford, were named by the distinguished authority in the group, the Vicomte R. du Buysson, of the Paris Museum. Mr. Rowland E. Turner, F.E.S., has visited Oxford more than once, and has worked out the *Thynnidae* and other Fossores. Several new species have been found and described by him, and these obscure and difficult insects brought into a satisfactory condition as the result of his kind help. Colonel C. T. Bingham, F.Z.S., F.E.S., has spent much time in working out the great collection of Ethiopian Hymenoptera in the Department. Large numbers of specimens determined by him have been brought back to Oxford. When the work is complete it will form a notable contribution to our knowledge of the insect fauna of the region.

Dr. G. B. Longstaff has rendered efficient and valuable help by working out the material of the collections presented by him, and for this purpose has paid many visits to Oxford. Seeing that the University Collection of Satyrine butterflies required rearrangement and much expansion to accommodate the large numbers of accessions, he very kindly offered to copy out the list of species which have recently been arranged in the British Museum. He was able nearly to complete this laborious task before his departure for Ceylon, and the University Collection has now been rearranged by Mr. Holland in accordance with his list.

As in previous years, the kindest help has been rendered by the staff of the Insect Department of the British Natural History Museum, and the Hope Department has also been able to assist these London friends by lending type specimens for study and comparison.

An immense amount of work has been thrown upon the staff of the Hope Department in printing and writing labels for specimens that have been worked out, and in replacing them in the collections.

In order to appreciate fully the assistance which the Hope Collections have received in the course of the year, a careful study of the memoirs mentioned in Section 10 would be necessary. To take a single example, Dr. Hancock's paper on the *Tetriginae* of the Hope Collection (*Trans. Ent. Soc.*, 1907, p. 213) contains the descriptions of 6 new genera and more than 30 new species.

9. *Visits of Naturalists, &c.*

The Department was visited by the Chancellor on Nov. 12.

The usual annual visit of the Entomological Society of London did not take place in 1907. The Department has been visited by the following naturalists, who have contributed valuable material to the University Collections:—Mr. W. J. Lucas (two visits); Mr. G. C. Champion (two visits); Mr. Rowland E. Turner; Dr. L. O. Howard, of Washington; Mr. H. S. Gladstone, of Lagos; Rev. K. St. Aubyn Rogers, M.A., Wadham College, of Rabai, Mombasa; Dr. R. C. L. Perkins, M.A., D.Sc., Jesus College, of Honolulu.

The Department has also been visited by Monsieur A. Conte, of the Silk Laboratory, Lyons; Professor Lacroix, of Paris; Father Joseph Assmuth, S. J.; Professor Maynard M. Metcalf, of Oberlin College, Ohio; Dr. S. W. Williston, of Chicago; Professor Karl Pearson, F.R.S.; Dr. G. Archdall Reid; Mr. H. J. Carter, of Sydney, N.S.W.; and Mr. J. F. Dutton, of Warrington.

10. *Work published in* 1907.

The following papers by workers in the Hope Department, or upon its material, have appeared in the Transactions of the Entomological Society of London during the year 1907:—

Read Nov. 21, 1906.—A permanent record of British Moths in their natural attitudes of rest, by A. H. Hamm, assistant in the Hope Department. This interesting paper was accidentally omitted from last year's Report.

Read March 6, 1907.—The Larva of *Collyris emarginatus*, Dej., by R. Shelford, M.A., F.L.S.

Read March 28.—Studies of the *Tetriginae* (Orthoptera) in the Oxford University Museum, by J. L. Hancock, M.D., F.E.S. (Chicago).

Read June 5.—Entomological Observations and Captures during the visit of the British Association to South Africa in 1905, by F. A. Dixey, M.A., D.M., F.E.S., and G. B. Longstaff, M.A., D.M., F.R.C.P., F.E.S.

Read Dec. 4.—Studies of the *Blattidae*, by R. Shelford, M.A., F.L.S. VIII. The *Blattidae* described by Linnaeus, De Geer, and Thunberg. IX. Synonymical Notes.

The following short papers have appeared in the Proceedings of the Entomological Society of London during the year 1907 :—

March 6.—Male Brands attacked by Pests, by the Professor.

Remarkable larva of *Spiramiopsis*, by the Professor.

Effect of Artificial Conditions on Seasonally Dimorphic Species, by Dr. F. A. Dixey.

March 20.—Parallelism between the genera *Phrissura* and *Mylothris*, by Dr. F. A. Dixey.

April 10.—Similarity between Dry-season Forms of Allied Pierine Species, by Dr. F. A. Dixey.

May 1.—Divergent Mimicry by the Females of *Leuceronia argia*, Fabr., by Dr. F. A. Dixey.

A case of Homoeotic Variation in a Cockroach, by R. Shelford.

June 5.—The Significance of some Secondary Sexual Characters in Butterflies, by the Professor.

Abstract of Entomological Observations and Captures during the Visit of the British Association to South Africa in 1905, by Dr. F. A. Dixey and Dr. G. B. Longstaff.

October 2.—*Sitaris muralis* at Oxford, by Commander J. J. Walker.

Transition between *Mylothris chloris*, Fabr., and *M. agathina*, Cram., by Dr. F. A. Dixey.

November 6.—New Species of *Pinacopteryx*, by Dr. F. A. Dixey.

November 20.—Mimetic Parallelism in Five Genera of African Pierines, by Dr. F. A. Dixey.

Association of Allied Forms of South American Butterflies, by Dr. G. B. Longstaff.

Abstract of Mimicry in North American Butterflies of the genus *Limenitis* (*Basilarchia*), by the Professor.

December 4.—Reciprocal Convergence in *Limenitis*, by the Professor.

New Species of *Belenois*, by Dr. F. A. Dixey.

Insect and other Foods of Blackgame, by Dr. F. Menteith Ogilvie.

Rest Attitude of *Hyria auroraria*, by J. C. Moulton.

In addition to the above-named papers in the publications of the Entomological Society, the following memoirs have appeared in the course of the year 1907.

A monograph on the *Blattidae* collected by Dr. Y. Sjöstedt in the Kilimandjaro district, by R. Shelford. In the Swedish Academy of Sciences (36 pp., 2 plates).

The first part of a Catalogue and Generic Revision of the *Blattidae*, by R. Shelford. In the Genera Insectorum, P. Wytsman, Brussels (13 pp., 1 plate).

Preliminary list of Coleoptera observed in the neighbourhood of Oxford from 1819 to 1907, by Commander J. J. Walker, Hon. M.A., R.N., F.L.S., Secretary of the Entomological Society of London. In the Ashmolean Natural History Society's Report. Within the seven-mile radius of Oxford, 1,399 species are recorded in this paper.

Some notes on the Lepidoptera of the "Dale Collection" of British Insects now in the Oxford University Museum, by Commander J. J. Walker. In the Entomologist's Monthly Magazine, 1907. I. Rhopalocera, pp. 93–101 and 130–4. II. Heterocera, pp. 154–7.

On some new species of *Blattidae* in the Oxford and Paris Museums, by R. Shelford. In the Annals and Magazine of Natural History for Jan. 1907, pp. 25–49.

Aquatic Cockroaches, by R. Shelford, M.A., F.L.S. In the Zoologist for June, 1907.

Abstract of Lecture on Mimicry, by Dr. F. A. Dixey, at the British Association at Leicester (1907). In Nature, vol. xxvi, 1907, p. 673.

Abstract of paper—Experiments on Seasonally Dimorphic Forms of African Lepidoptera—read by Dr. F. A. Dixey before Section D of the British Association at Leicester. In Report of the meeting, p. 540.

Sitaris muralis, near Oxford, by A. H. Hamm. In the Entomologist's Monthly Magazine for 1906, pp. 273, 274. Accidentally omitted from last year's Report.

In addition to the above, a large amount of work done in 1907 has been or will be published in the course of the present year. Thus Mr. J. C. Moulton, Magdalen College, has devoted much time to the preparation of an account of the Burchell Brazilian Nymphaline and Hesperid butterflies, and Mr. G. Meade Waldo, B.A., of Magdalen College, has studied an especially interesting and remarkable case of mimicry in the Nymphaline butterflies of Africa.

11. *Sixth volume of Hope Reports.*

The materials stored in the Department are amply sufficient for a sixth volume, which will be issued as soon as the present Report for 1907 is printed. In addition to the ordinary series of octavo volumes, separata of quarto papers have been accumulating for some years, and the issue of a volume of this size cannot be far distant. Separata for a special volume on the Burchell Collection are also steadily accumulating.

12. *Exchange of Hope Reports with the Publications of Foreign Entomological Societies.*

The Swiss Entomological Society has exchanged a complete set of its publications for the five volumes of Hope Reports, and will hereafter exchange regularly. The Professor desires to acknowledge the generosity of the Swiss Society and to express his thanks to Dr. Th. Steck, of Berne, for his courteous communications on the subject.

Additions to the Collections in 1900.

Two hundred and forty-three Diptera from the neighbourhood of Kuching, Sarawak, Borneo, presented by R. Shelford, Esq., M.A., Emmanuel College, Cambridge, were catalogued and added to the Collection, together with a few uncatalogued specimens. This valuable accession forms part of the splendid collection of insects of various orders captured by Dyak collectors and presented by Mr. R. Shelford in 1899, 1900, and 1901.

Additions to the Collections in 1901.

Sixty-five Coleoptera and 8 Rhynchota, presented by H. D. Acland, Esq., have been added to the Collection. The specimens, many of which belong to extremely fine species, were formerly in the possession of Sir Henry Acland, K.C.B., F.R.S. They are unfortunately without data.

Additions to the Collections in 1903.

Two hundred and eighty-five *Tetriginae*, part of the great collection presented in 1903 by Malcolm Burr, Esq., B.A., F.G.S., F.E.S., New College, have been catalogued and incorporated, together with 201 *Phasmidae* and a few uncatalogued specimens. As the various parts of the University Collection of Orthoptera are named and arranged, the corresponding groups included in Mr. Burr's great and valuable gift are also determined and incorporated. The remarkable grasshoppers (*Acridiidae*) of the sub-family *Tetriginae* were incorporated during the past year after study and determination in Chicago by Dr. G. L. Hancock, who has published an interesting paper on the whole of the Oxford material (*Trans. Ent. Soc. Lond.*, 1907, pp. 213–44, pl. xxi).

An interesting series of 325 butterflies, the result of a single day's collecting 8–10 miles from the Potaro River, on the road to the Gold Mines in British Guiana, was purchased from the captor, Mr. C. B. Roberts. The road leaves the river 30 miles above its confluence with the Essequibo. All the specimens were captured Aug. 23, 1903, on the white flowers of *Eupatorium macrophyllum*, which

springs up wherever the forest is cleared. Forty-five of the best specimens and most unusual varieties have been catalogued and permanently added to the Collection : the remainder are exhibited, as described in last year's Report, in the Upper S. corridor of the Museum, outside the Hope Department. Against a wall facing N. and covered except in the afternoons by a blind, they will doubtless remain without any perceptible change in the pigments for many years. An account of the day's capture will be found in the *Proceedings of the Entomological Society of London*, 1903, p. liv.

A small collection of Coleoptera from a great variety of localities (Europe, Egypt, Cyprus, Brazil, N. Guinea, Australia, S. Africa, China, Japan, Chile) was presented by the Rev. A. Thornley, M.A., F.L.S. Fifty-six specimens have been catalogued and many others also incorporated. Seven Cicadas presented by the same donor are unfortunately without data. They are, however, wanted in the Collection, and have been provisionally incorporated.

Additions to the Collections in 1904.

An interesting set of 325 butterflies captured near the Potaro River, British Guiana, by Mr. C. B. Roberts, on Feb. 23, 1904, compares in an instructive manner with that taken by him in the same locality on Aug. 23, 1903. The whole of the specimens are exhibited side by side with the great majority of those captured on the latter date. They were shown at the meeting of the Entomological Society of London on June 6, 1906 (see *Proceedings* of that date, where an analysis of the whole group is published).

Additions to the Collections in 1905.

An immense amount of labour has been involved in setting, cataloguing, incorporating, and especially in printing labels for the very large collection brought from South Africa, Mombasa, and Egypt, as a result of the visit of the British Association in 1905.

Dr. G. B. Longstaff, M.A., D.M., New College, and Dr. F. A. Dixey, M.A., D.M., Wadham College, collected in the

following localities:—Cape Town and the neighbourhood, including Table Mountain (early in August and again in October); Port Elizabeth and East London (early August and again at the end of September); various localities near Durban, Colenso, and Ladysmith (August); Johannesburg (end of August and beginning of September); Bloemfontein, Kimberley, and Bulawayo, including the Matoppos (early September); and the Victoria Falls of the Zambesi (September 11–20). In addition to the above, small numbers of specimens were captured at many stations on the S. African railways, altogether constituting an important addition to the Collection. The records of locality and date are full and precise. The specimens differ, as regards locality, from those captured by other naturalists who accompanied the British Association, in the very interesting collection made at Port Elizabeth and East London and in the far greater number of representatives from the Victoria Falls. A valuable account of the localities and the habits of many of the species has been published by Dr. F. A. Dixey and Dr. G. B. Longstaff in *Trans. Ent. Soc. Lond.*, 1907, pp. 309–81. A reference to this paper is printed on all the labels of locality and date.

Of Dr. Longstaff's collection no fewer than 1,314 Arthropoda, almost exclusively insects of various orders, have been catalogued and incorporated in the general collection, together with large numbers provisionally added to the Museum series. Of Dr. F. A. Dixey's collection 391 specimens have been catalogued and, together with numbers of others, incorporated. It is of course impossible to describe these large and valuable collections in any detail. The Coleoptera presented by Dr. Longstaff include the types and co-types of the Curculionid beetles *Ellimenistes callosicollis* and *Myorrhinus longstaffi* of G. A. K. Marshall.

The Hymenoptera include new species of the Aculeate genera *Halictus*, *Prosopis*, *Ceratina*, and *Odynerus*. Dr. Dixey's collection contains new species of Fossorial Aculeates belonging to the genera *Scolia* and *Notogonia*. Colonel C. T. Bingham has kindly consented to describe these new Aculeates, together with many other new Ethiopian species in the Uni-

versity Collection. Both collections include long series of Acraeine butterflies (hitherto excessively rare in European collections) from the Victoria Falls (see G. B. Longstaff in *Proc. Ent. Soc. Lond.*, Feb. 7, 1906), and Dr. Longstaff's an extremely fine species allied to *Nemoptera* from the same locality.

In addition to the numbers of specimens already mentioned and incorporated in the General Collection, both Dr. Longstaff and Dr. Dixey presented long series of specimens which have been included in the bionomic series. Both collections, especially Dr. Dixey's, are very rich in the material upon which bionomic observations had been made during life. Thus the pleasant, presumably epigamic, scents of the males of certain butterflies, as well as the unpleasant, presumably aposematic, scents of both sexes of others, were studied in large numbers of examples, constituting a most interesting mass of material. Among many specimens specially prepared to illustrate the procryptic attitudes of butterflies, Dr. Longstaff's collection includes the four specimens of *Eronia cleodora* figured in Plate XXV of the *Trans. Ent. Soc. Lond.*, 1907. These four Eronias, accompanied by a coloured drawing of the leaves of the Acanthaceous plant the "u- Bomaan" (*Ectimanthus origanoides*), upon which the species has been observed to rest, and Mr. Horace Knight's beautiful drawing from which the plate was made, have been added to the bionomic series. The drawings were also presented by Dr. Longstaff. The collections also include a series of Lycaenid butterflies, chiefly Dr. Longstaff's, set in such a manner as to display the head-like appearance at the anal angle of the hind wing. Dr. Dixey's collection also contains specimens illustrating procryptic attitudes of butterflies, and examples showing that the dry-season male of *Belenois thysa* is a far better mimic of *Mylothris agathina* than the wet-season male. Both collections were drawn upon to provide illustrations of procryptic and mimetic colouring in Coleoptera, as well as further examples of the mimicry of *Mylothris* by other *Picrinae*.

Of the specimens captured by the Professor on the same

visit to S. Africa, 1,462 Arthropoda, almost exclusively insects, have been catalogued and added to the General Collection, together with many uncatalogued specimens. A considerable proportion of these were captured during the short visit to Mombasa and the adjacent mainland, and a small number during a few hours at Mozambique. It is unnecessary to mention the S. African localities, as, with the exceptions already noted, they were the same as those visited by Dr. Longstaff and Dr. Dixey; and the same list will also serve for the specimens presented by many other naturalists who accompanied the British Association. Among the additions to the bionomic series presented by the Professor were many fragments of locusts and a Heteromerous beetle found lying on the veldt near Bloemfontein (Sept. 2)—evidence of the struggle for existence—also a young ant-like *Mantis*, together with two of the models swept from herbage at the same time (Salisbury, Sept. 15). A large spider and one of its young, together with the fragments of 20 insects and millipedes found in the nest (Bloemfontein, Sept. 2), were presented by the Professor and Guy A. K. Marshall, Esq. In addition to the above, 135 specimens from various S. African localities, presented by Guy A. K. Marshall, Esq., have been catalogued and incorporated, together with 4 from Kimberley, presented by him and the Professor.

An interesting collection from the S. African localities and Mombasa, including a few specimens from Mozambique, the Red Sea, and the Mediterranean, was presented by the captor, J. R. Cleland, Esq. Of these 216 have been catalogued and many others added to the collection. In addition to the above, 43 specimens, chiefly Coleoptera from Warrenton, Cape Colony, were presented by the Professor and J. R. Cleland, Esq., and examples of *Phyllodromia germanica* from the SS. "Durham Castle" by Mrs. Cleland.

Of the S. African specimens, together with a few from Beira and Mombasa, presented by the Hon. G. L. Parsons, M.A., Balliol College, 106 have been catalogued and incorporated, together with 26 presented by the same donor and the Professor.

The following specimens have been catalogued and incor-

porated from small S. African collections made at various localities and presented by the following donors:—Professor C. V. Boys, F.R.S., 16 specimens; Professor C. V. Boys and Colonel Bigg-Wither, 3 specimens; Professor Hudson Beare, 14 specimens; Miss Margaret L. Poulton, 20 specimens; Miss Poulton, 2 specimens; Miss Thornley, 25 specimens; Professor W. A. Herdman, F.R.S., 3 specimens; Professor A. C. Seward, F.R.S., 2 specimens.

Single S. African specimens were also presented by the following donors:—Miss Burley; Miss Molly Jenkins; Miss Rose; H. Balfour, Esq., M.A., Exeter College; Professor G. H. Bryan, F.R.S.; G. F. Leigh, Esq.; Professor W. B. Scott, of Princeton University; E. H. Short, Esq.

A very large red "tick" (Acarina) from Umkomaas, near Durban, Natal, was presented by E. A. S. Weale, Esq. The Acarid remained alive for several weeks, gradually contracting and extruding the immense mass of minute ova with which the body was filled.

Single specimens from Mombasa were presented by Lord Ross, F.R.S., and Professor W. J. Sollas, F.R.S., 2 by C. A. Wiggins, Esq., and 2 by H. T. Ferrar, Esq.

The "Durham Castle" steamed through a small flight of migratory locusts crossing the Red Sea from W. to E. on Sept. 30. A few specimens alighted on the ship, and examples were presented by Mrs. Hudson Beare, the Chief Officer, H. B. Marriott Watson, Esq., J. Hutchins-Ward, and the Professor. A Scarabaeid beetle which alighted on the ship was presented by Mrs. E. B. Poulton. A *Blatta* and an *Eristalis* captured on the ship in the Mediterranean were presented by the Professor.

Sixty-five insects, especially Coleoptera and *Acridiidae*, from various localities near Cairo, and a few between Suez and Cairo (Oct. 4–8), have been catalogued and incorporated out of the collection presented by the Professor. The majority were captured in the Temple of the Sphinx (Oct. 5) and other localities near the Pyramids of Ghizeh (Oct. 5 and 6), and in the garden of the Barrage (Oct. 7). Six insects from the vicinity of Cairo (Oct. 6 and 7), chiefly the Zoological Gardens,

were presented by J. R. Cleland, Esq., and one (Oct. 4) by Miss Banks.

Eighteen insects and 5 spiders from the neighbourhood of Funchal, Madeira (July 26 and Oct. 17), were presented by Dr. G. B. Longstaff, and 6 insects captured on the same dates by Dr. F. A. Dixey. Thirteen insects from the same locality (July 26) were presented by the Professor.

One hundred and two butterflies, captured April–June, 1905, at Fort Mlangeni (3,500 ft.), in the Liwonde District, 30 miles S. of Lake Nyassa, British Central Africa, were presented by H. A. Byatt, Esq., B.A., Lincoln College. The condition of the majority of specimens was not very satisfactory, so that only 14 have been catalogued as permanent additions, although the interest of the locality is so great that a large proportion has been provisionally incorporated in the Collection. Among the most interesting accessions are many well-marked dry-season representatives of species of the genera *Precis* and *Melanitis*, the latter including several specimens of the local *Melanitis libya*.

An extremely fine collection of Coleoptera, made in June, July, and August, 1904, by Herr von Rengarten, on the Shilka River, near Gorbitza, Transbaikalia, Eastern Siberia, was presented by Dupre P. Lance, Esq. Dr. G. B. Longstaff kindly drew the attention of the generous donor to the value which would be attached to specimens from so interesting a locality by the Hope Department. Herr von Rengarten kindly supplied the fullest information as to dates and locality. The collection was preserved in vodka, and the mass of beetles must have weighed many pounds. Commander J. J. Walker, Hon. M.A., F.L.S., kindly undertook the very considerable labour of sorting out this vast amount of material into species, and selecting series for the University Collection. Just over a thousand specimens have been incorporated, and of these no less than 844 were catalogued. Several species were kindly determined for the Department by Dr. K. Brancsik. In addition to the Coleoptera, 21 insects of various Orders from the same locality were catalogued and incorporated.

Additions to the British Collections in 1905.

The splendid collection of nearly 7,000 British Micro-Lepidoptera presented by Mrs. E. C. Bazett, of Reading, have now received their printed labels, and have been added to the British cabinets. The series of specimens is one of the finest donations ever received by the British Collections. The majority were captured at no great distance from Oxford, in the Reading district.

Additions to the Collections in 1906.

A fine collection of butterflies with excellent data from Rabai, 14 miles N.W. of Mombasa, was presented by the Rev. K. St. Aubyn Rogers, M.A., F.E.S., Wadham College. Only a portion of the collection, including 109 specimens captured Feb.–June, 1906, has been catalogued and incorporated. The *Lycaenidae* include many species of great interest, such as 1 *Epamera diametrica*, new to the Hope Department; 1 *Spindasis kallimon*, H. H. Druce, recently described; 4 *Telipna rogersi*, H. H. Druce, a new species discovered by the donor and only just described; 1 *Virachola dariaves*; 2 *Alaena picata*, and 1 *Pentila peucetia*. Among the *Nymphalinae*, 3 *Pseudacraea trimeni* and 5 *Euxanthe tiberius* were especially valuable, and the latter hitherto unrepresented. Further examples of both species have since been received from this most generous friend to the Department, and two of *E. tiberius* have been exchanged with the British Museum of Natural History for two of *E. trajanus*, new to the Department. Next year's Report will include a complete and detailed account of the fine collection of butterflies from Rabai and many other localities in British East Africa presented by the Rev. K. St. Aubyn Rogers. The great labour of setting and printing is finished, and the final cataloguing and incorporation will be complete at an early date.

A large collection of butterflies from various localities was presented by R. S. Standen, Esq. Of these 72 have been catalogued as permanent accessions, while large numbers have also been provisionally added to the Collection. The specimens from Thursday Island, Torres Strait, Fiji, Hapaii

and Vavao (Friendly Islands), and Samoa are especially valuable, inasmuch as these localities are unrepresented or very poorly represented in the Department.

Five examples of the interesting Pierine butterfly *Tatochila blanchardi*, and two of *T. demodice* from Chile (1882–4), together with two of *T. autodice* from Monte Video (Dec., 1880), were presented by the captor, Commander J. J. Walker, R.N., Hon. M.A., F.L.S., F.E.S. The data are full and precise and the specimens a valuable addition to the species of the genus in the Department.

Seventy-eight Orthoptera, chiefly *Acridiidae*, from various localities in N.E. Rhodesia (1904–5), were presented by S. A. Neave, Esq., M.A., B.Sc., Magdalen College, and the British South African Company. The specimens, which were collected by Mr. Neave, are accompanied by admirable data of both time and place. The Acridians included a single example of a single species belonging to the sub-family *Tetriginae*. This specimen has been made the type of a new genus and new species, *Cladoramus crenulatus*, by Dr. J. L. Hancock, of Chicago. This, the only example of the sub-family captured by Mr. Neave, was found at Petauke (2,400 ft.) in the East Loangwa District of N.E. Rhodesia (Dec. 20, 1904).

A series of 26 Diptera, chiefly *Asilidae*, and 7 Fossorial Hymenoptera from Burma (1887–1900), and one Fossor from Sikkim (1894), were presented by Colonel C. T. Bingham. Precise and detailed data accompany all the specimens.

ADDITIONS TO THE BRITISH COLLECTIONS IN 1906.

Seventeen insects from Kent, the New Forest, and the Oxford District were presented by Commander J. J. Walker, R.N., Hon. M.A., F.L.S., F.E.S. The specimens include 4 examples of the earwig, *Anisolabis annulipes*, Queenborough (August, 1906); 3 of a Dipteron, *Stenopteryx hirundinis*, from a swift's nest; and 5 of a flea, *Pulex erinacei*, from the hedgehog, Cobham Park (July, 1899). A most interesting addition to the bionomic series consists of a specimen of the ant-mimicking Staphylinid, *Astilbus* (*Myrmedonia*) *canaliculatus*, found

on May 30, 1906, carrying a freshly killed ant, *Lasius niger*, in its mandibles: from the Cumnor Hill stone-pit.

An example of the very interesting ab. *columbina*, Image, of *Nola confusalis*, Herr.-Sch., from Epping Forest (May 26, 1906), was presented by the captor, Selwyn Image, Esq., M.A., F.E.S., of New College.

A moth, Oxford (June, 1906), and two examples of *Microglossa marginalis*, a very rare Staphylinid beetle found in birds' nests at Huntingfield, Kent (July, 1906), was presented by the captor, the late A. J. Chitty, Esq., M.A., F.E.S., K.C., Balliol College.

A specimen of the rare Staphylinid, *Lathrobium punctatum* (*atripalpe*), from Harper's Rig Reservoir, Midlothian (April 7, 1903), was presented by the captor, Professor T. Hudson Beare, F.R.S.E., F.E.S.

Sixteen specimens of British butterflies from Herefordshire (1902) and Barmouth (1902) were presented by the captor, Colonel J. W. Yerbury.

A Chelifer from St. John's Road, Oxford (Oct., 1906), was presented by the captor, W. W. Taylor, Esq., M.A., Queen's College.

One of the "diamond beetles" (*Phyllobius*), from the Parks Observatory (May 15, 1906), was presented by the captor, Miss Bellamy.

Forty-four insects of various groups, from the New Forest (1898–1906) and various localities in Surrey (1897–1906), were presented by the captor, W. J. Lucas, Esq., B.A., F.E.S. The series includes 2 *Mecostethus grossus*, *Raphidia notata*, *Psocus longicornis*, *Ps. nebulosus*, and *Cloeon similis*. The data are full and precise.

Thirty-six insects of various groups from Streatley, St. Helens (Isle of Wight), Limpley Stoke, Tubney, Yarnton, Beckley, S. Hincksey (1904–6), were presented by the captor, Mr. W. Holland, of the Hope Department. A fine set of specimens of the rare Pentatomid bug, *Aelia acuminata*, from Streatley, is included, together with examples of the Phytophagous beetle, *Apteropoda orbiculata*, with its Hemipterous mimic, *Halticus apterus*, captured with it; also the ant, *Myrmica*

rubra, with the mimetic Staphylinid beetle *Astilbus* (*Myrmedonia*) *canaliculata*, captured at the same time and under the same conditions. Both these examples were exhibited to the Entomological Society of London (*Proceedings*, 1906, p. lxii).

Eighteen insects from various localities in the neighbourhood of Oxford (1905, 1906) were presented by the captor, Mr. A. H. Hamm. They include four *Sitaris muralis* (a pair captured *in coitû*, and a specimen found in a spider's web, for the bionomic collection), a series of the Apterous fly *Elachyptera brevipennis*, and of the Asilid *Neoitamus cyanurus*; also, for the collection illustrating mimicry, 2 humble-bees and a mimetic fly captured together.

Twenty-one insects from the following localities near Oxford: Cumnor, Wytham, Tubney, and Henwood; and from Cheshire and Lancashire, were presented by Mr. J. Collins. They include 3 examples of the "footman" moth *Lithosia sericea* (July 21, 1906), confined to the Warrington district; 3 of the local *Leucorrhinia dubia*, from Delamere Forest (June 27, 1906); and from the Oxford localities 2 examples of the rare Staphylinid, *Lathrobium quadratum*; and an example of the Asilid genus *Neoitamus*, determined as *N. cothurnatus* by G. H. Verrall, Esq. This is the only example of the species which has been found in Britain since Mr. Holland's original discovery of the species at Tubney in June, 1895, and his rediscovery in June, 1901 (see G. H. Verrall in *Proc. Ent. Soc. Lond.*, 1904, p. xxxiii).

The Geometrid moth *Cidaria miata*, from the Electrical Department of the University Museum (Sept., 1906), was presented by the captor, Mr. G. A. Bennett.

A specimen of the Oriental cockroach *Periplaneta australasiae*, introduced into Oxford in bananas and captured July 4, 1906, was presented by C. J. Bayzand, Esq.

A beetle and a spider found in or near the Museum were presented by the captor, Mr. H. Trim.

The moths *Triphosa dubitata* and *Notodonta dictaea*, from Oxford (Aug. 21, 1906), were presented by the captor, Mr. J. W. G. Belcher.

A Locustid and a spider (May 12 and Sept. 1) were presented by Mr. H. Mills.

Three Diptera captured on the Museum windows (Feb. 17, 1906), and a pair of *Bombus hortorum* captured *in coitû* at St. Helens, Isle of Wight, were presented by the Professor.

The following examples of predaceous insects and their prey were inadvertently omitted from *Trans. Ent. Soc. Lond.*, 1906, pp. 323–409. They will appear in an Appendix to the second part of that memoir.

From H. Donisthorpe, Esq., F.E.S. :—

Captor	*Prey*	*Locality and date*
DIPTERA *Scatophaga stercoraria* ♀	*Bibio johannis* ♂	Hanwell, May 27, 1904
" " ♀	" " ♂	" "
HYMENOPTERA PHYTOPHAGA *Allantus temulus* ♂	*Empis tessellata*	Charing, N.E. Kent, June 11, 1904

From G. H. Verrall, Esq., F.E.S. :—

ODONATA *Ischnura elegans* ♀	*Leptocerus aterrimus* ♂	Newmarket, June 16, 1906

The following examples published in the memoir above referred to have been catalogued and incorporated since the appearance of the last Report :—

(1) Captured and presented by Col. J. W. Yerbury, the Empid fly *Ocydromia glabricula* ♀ with its prey, a Mycetophilid fly *Sciara* sp. ♂, from Porthcawl, S. Wales, July 17, 1906 (l. c. No. 285, p. 385); also the Empid, *Tachydromia minuta* ♂ with its prey, a minute Cynipid of the genus *Alloxysta*, from Porthcawl, June 22, 1906 (l. c. No. 290, p. 385).

(2) Captured and presented by J. E. Collin, Esq., F.E.S., the Anthomyid fly *Fucellia maritima* ♀, the prey of the Asilid fly *Philonicus albiceps* ♂, from Studland, Dorset, Aug. 22, 1906 (l. c. No. 143, p. 347).

Additions to the Collections in 1907.

The collection of Orthoptera, especially the *Blattidae*, has been enriched by many accessions as the direct result of Mr. Shelford's labours.

Twenty-eight *Tetriginae* and 7 *Blattidae* from Mexico (1898) and the following States:—Illinois (1895–1906), Indiana (1895–1903), Massachusetts (1899), Texas (1907), and Wisconsin (1901), were presented by Dr. G. L. Hancock, of Chicago. The value of the donation was increased by the fact that the species have been determined by this distinguished Orthopterist.

Thirty-four *Blattidae* from various localities were presented by the Musée d'Histoire Naturelle, Paris. The majority of the species are new to the Hope Collection, and most of them are co-types of species recently described in the Department by R. Shelford, Esq., M.A., Emmanuel College, Cambridge.

Two examples of the gigantic "earwig" (*Forficulidae*) *Anisolabis littorea*, from Wellington, North Island, New Zealand (Dec., 1901), another very fine Forficulid from Westport (Dec. 31, 1901), and two Acridians from Porter's Pass, 3,200 ft. (Dec. 27, 1901), were presented by the captor, Commander J. J. Walker, R.N., Hon. M.A., F.L.S., F.E.S. The two latter localities are in the South Island. Commander Walker also presented two Forficulids, *Anisolabis tasmanica*, captured by him on Mt. Wellington, Tasmania, 4,100 ft., and a Blattid, *Cosmozosteria* sp., from Sydney, collected (1906) by H. J. Carter, Esq.

A series of 48 Orthoptera, chiefly *Blattidae*, were received in exchange from Dr. J. A. G. Rehn. The specimens, which were captured in various localities, mainly in tropical America, were all determined by Dr. Rehn.

Fifty-eight *Blattidae* from various localities in Australia, and collected at various dates, were presented by W. W. Froggatt, Esq. The data are full and precise, and the series a valuable addition to the Collection.

Fifty-seven *Blattidae* from the Kilimanjaro district were presented by Professor Yngve Sjöstedt, of Stockholm. This

valuable accession includes the co-types of 10 new species described by Mr. R. Shelford.

Eighty-seven *Blattidae* from various localities were presented by R. Shelford, Esq., M.A., Emmanuel College, Cambridge, F.L.S., F.E.S. This valuable addition to the Collection includes the types of *Nauphoeta epilamproides*, Shelford, and *Protagonista lugubris*, Shelford.

Three *Blattidae*, examples of 3 new species from the neighbourhood of Kuching, Sarawak, Borneo, were presented by the Sarawak Museum.

Eleven *Blattidae* were presented by the Deutsche Entom. Nat. Mus., Berlin, including the type of *Chorisoneura pallida* ♀, Shelford, and co-types of the following species described by the same authority, *Nauphoeta elegans*, *N. epilamproides*, and *Phyllodromia mirabilis*.

A valuable series of 59 Orthoptera was presented by Dr. K. Brancsik, including the types of many species described by the donor. Among the *Blattidae* is the type of *Aphlebidea brunneri* and the types of five other species; among the *Mantidae*, *Orthodera laticollis*; among the *Locustidae*, *Cymatomera brancsiki* of Brunner von Wattenwyl; while the *Acridiidae* contain the types of 9 species described by Dr. Brancsik.

Eighteen *Blattidae*, from the Kurumadzi River in Portuguese East Africa (Nov. 1906), were presented by G. A. K. Marshall, Esq., together with 3 *Achetidae* from the same locality. The specimens were collected by C. F. M. Swynnerton, Esq.

Six *Blattidae*, including co-types of *Cardax willeyi*, Shelford, were presented by the Trustees of the British Museum of Natural History.

An exotic Blattid, *Phyllodromia* sp., introduced in bananas and captured at Plymouth (Oct. 1906), was presented by the captor, J. H. Keys, Esq.

An undescribed species of Blattid, *Panesthia* sp., a Forficulid, and a series of 33 fine Coleoptera, collected (Oct. 1895) on Masarang Mt. (3,000–4,000 ft.), N. Celebes, by Dr. C. Hose, were presented by the Linacre Department of Comparative Anatomy.

Four *Blattidae* collected (1906) by Prof. Vosseler in Amani,

German East Africa, were presented by the Berlin Zoological Museum. They include the co-type of a new species, of which Mr. Shelford's description is now in the press.

Thirteen *Blattidae* from the Cameroons, from German S.W. Africa, and from German New Guinea, were presented by the Wiesbaden Natural History Museum. They include 7 co-types of new species, of which Mr. Shelford's description is now in the press.

Thirty-three *Blattidae*, from New Guinea and various localities in Australia, were presented by the National Museum, Melbourne. They include several new species, to be hereafter described by Mr. Shelford.

A splendid set of 1,427 moths, collected about 1904 in the Khasia Hills, Assam, was presented by Herbert Druce, Esq., F.L.S., F.Z.S., F.E.S. Many of the species are minute and excessively delicate, but nevertheless their condition is very unusually perfect. They have been beautifully set by Mr. Cant, and the whole collection forms one of the finest donations ever received by the Department. All have now been added to the Collection and no less than 1,040 catalogued. The great majority of the species belong to the *Geometridae*, *Noctuidae*, and *Pyralidae*. In addition to the above 1 Lycaenid butterfly and 6 Neuroptera from the Khasia Hills were presented by the same generous donor.

A very valuable series of ants, preserved in spirit, was presented by R. C. Wroughton, Esq., F.Z.S. The great majority are from the Oriental Region, but a certain number of specimens are Australian, S. African, and American. The specimens have been studied by Professor Auguste Forel and Colonel C. T. Bingham, and many are co-types of these distinguished authorities. The donation is a most valuable addition to the University Collection of a most interesting group of insects.

Specimens of the larva (from Orotava, Teneriffe, May 5, 1907) and imago (Santa Cruz, Jan. 3, 1907) of *Danaida* (*Limnas*) *chrysippus* were presented by the Rt. Hon. Lord Walsingham, F.R.S. The larva has been beautifully preserved by the donor.

The following valuable series of types and co-types of *Curculionidae*, described in *Proc. Zool. Soc. Lond.*, 1906, p. 911, by Guy A. K. Marshall, Esq., F.E.S., &c., have been presented by the author, who has added so generously to the University Collections for many years:—*Ectatops sheppardi* ♀ ; *Strophosomus salisburiensis* ♂ ; *Strophosomus binotatus* ; *Strophosomus sulcatifrons* ; *Platycopes alfredensis* ♂ and ♀ ; *Piazomias varicolor* ♀ ; *Piazomias pratensis* ♂; *Rhinosomphus mutabilis* ♂; *Systates dentipes*, type ♀ , co-type ♂; *Zeugorygma orangiae* ; *Cyclomus algoensis* ♀ ; *Cyclomus simplex* ♂ ; *Rhyparasomus mashunus* ♀ ; *Hypsomus parvus*, 2 co-types ; *Phacemastix poultoni* ♀ ; *Aplemonus zizyphi* ; *Balaninus nubifer* ♂; *Balaninus ficorum* ♂; *Balaninus aurivillii* ♂; *Balaninus barkeri* ♀ ; *Balaninus diversicornis* ♀ ; *Neiphagus mashunus* ; *Endaeus floralis* ♀ ; *Endaeus hispidus* ♂; *Acanthorrhinus zambesianus* ♀ .

One hundred and fourteen Australian *Mutillidae*, representing 27 species, chiefly captured by G. Turner, Esq., at Port Mackay, Queensland (1900), were presented by Rowland E. Turner, Esq., F.E.S., brother of the captor. All the species of this valuable addition to the Collections have been determined by the donor. The donation also includes 4 examples of an interesting Tenthredinid from the same locality.

An example of *Amauris echeria*, the model of the *cenea* female form of *Papilio dardanus* subsp. *cenea*, was presented by the captor, G. F. Leigh, Esq., F.E.S. The specimen was captured near Durban, Natal (Mar. 1907). An example of the Nymphaline butterfly *Charaxes ethcocles*, flying to light in the evening and bitten by a bat, Durban (Mar. 28, 1907), was presented by the same donor.

A number of insects of various Orders, collected by Mr. H. S. Rohu in British New Guinea (Aug. 1900–Mar. 1901), were presented by H. Balfour, Esq., M.A. The locality is of much interest—Tamata and Gira, below Mount Albert Edward, between Holnicote Bay and the Anglo-German boundary. Sixty-one specimens, including nearly the whole of the collection, have been catalogued and incorporated.

A series of Oriental Asilid flies, with admirable data, were presented by the captor, Colonel C. G. Nurse. The Diptera were

collected at the following extremely interesting localities:—British Baluchistan, Quetta (6,000 ft., 1902–3), 60 specimens; Pishin (5,000 ft., Apr. 1902), 2 specimens; Kashmir (8,000–9,000 ft., June, 1901; 5,000–6,000 ft., May 1901; 5,000 ft., Apr. 1901; 4,000 ft., June, 1901), 7 specimens; Bombay Presidency, Disa (1897, 1901), Bombay (1904), 19 specimens.

Thirty-nine butterflies, of which 19 have been catalogued, from various localities in Mauritius (1905–7), were presented by the captor, Colonel N. Manders, F.E.S. The data are full and precise, and the specimens are a most interesting addition to the island forms in the University Collections. Colonel Manders also presented a valuable series of 255 specimens of the Satyrine butterfly *Melanitis leda*, taken by him between March 10 and Dec. 31, 1905, at Curepipe, Mauritius (about 1800 ft.). All the specimens are carefully dated. Setting was a matter of great difficulty, from the effects of formaline which had been added to destroy mould; but Mr. A. Cant, F.E.S., to whom the butterflies were entrusted, has succeeded in displaying them admirably, in spite of this obstacle. This species has for many years been known to exhibit seasonal changes in a marked degree, the wet-season individuals possessing well-developed "eye-spots" on the under sides of the wings. In specimens of the dry season the apex of the fore-wing is produced and bent, while the under-surface, without eye-spots, beautifully resembles a dead leaf, the appearance of black, leaf-attacking fungi being often represented by the so-called "ink-marks." Although so well known, the nature and mode of incidence of the physiological stimulus which causes the change is still imperfectly understood, and the problem, apparently so simple, is of great difficulty. This fine series, all set to show the under-surface of the wings, and arranged in order of date, side by side with the rainfall of the locality for the year 1905, cannot fail to throw much light upon it.

Seven butterflies from Bourbon (Réunion), captured in April, 1907, were also presented by the same donor. Very few examples from this island exist in the Hope Department.

Forty-nine butterflies and 13 moths, captured by Colonel

Downes (July, 1905–June, 1906) in various localities in Mauritius, were presented by the Rev. Arthur M. Downes. The specimens were unfortunately in poor condition, but many of them will be of value to the Collection.

Thirty-two insects of various Orders, from the Botanical Gardens, Singapore (Jan.–Mar. 1907), were presented by the Director, H. N. Ridley, Esq., M.A., F.R.S., Exeter College. Sixteen specimens have been catalogued, and nearly the whole incorporated.

A very valuable series of 56 wasps (Diploptera), from various localities, especially in Mexico (1903), was presented by the Vicomte R. du Buysson, of the Musée d'Histoire Naturelle, Paris. The value of this important gift was greatly increased by the fact that all the species were determined by this distinguished authority on the Diploptera.

Many examples of the Nycteribiid, *Cyclopodia sykesii*, parasitic on the fruit-eating bat, *Pteropus giganteus*, were presented by H. Scott, Esq. The specimens were collected (Feb. 23, 1907) by Paymaster T. Bainbrigge Fletcher, R.N., on Barberyn Island, to the west of Ceylon.

Two male specimens of the beautiful Nymphaline butterfly *Euxanthe trajanus*, from the Cameroons, were received in exchange from the British Museum of Natural History.

An example of the conspicuous distasteful Pierine genus *Delias*, together with a Nymphaline mimic belonging to the genus *Mynes*, was presented by Dr. R. C. L. Perkins, D.Sc., M.A., Jesus College. The specimens, which were bred at Cairns, Queensland (Aug. 1904), are an interesting addition to the bionomic series.

Four Euploeas, with 4 examples of an Elymniine mimic, from German New Guinea (about 1897), were presented by Mr. A. H. Hamm, of the Hope Department—an interesting accession to the bionomic collection.

Dr. Longstaff's valuable collection from the West Indian Islands and South and Central America has received its printed labels, and is ready for cataloguing and incorporation. It is, however, kept back until the donor's papers have appeared, in order that a special reference label may be

printed and added to the specimens. The collection contains approximately the following numbers of specimens from the various localities visited:—Jamaica, 1,200; Barbados, 62; Trinidad, 215; Tobago, 225; Venezuela, 744; Colombia, 112; Panama, 140; total, 2,698. The numbers are in reality greater, because several specimens, when mounted on a single card, are counted as one.

Two interesting families, bred from mimetic female forms of *Papilio dardanus*, subsp. *cenea*, were purchased from Mr. G. F. Leigh, of Durban. In the first of these the parent, of the *cenea* form, mimicking *Amauris echeria* and *albimaculata*, was captured Jan. 14, 1907, and laid 42 eggs, Jan. 15 and 16. From these, 32 butterflies were successfully reared, and included 15 males (non-mimetic), 16 females of the *cenea* form resembling the female parent, and a single female of the form *hippocoon*, mimicking the very different *Amauris*, *A. niavius* subsp. *dominicanus*. The second family, bred, about the same time from a *hippocoon* female (the parent, with its data, was inadvertently retained by Mr. Leigh, who has promised to send it at a later date), consists of 29 butterflies, made up of 16 males and 13 females, all of the *cenea* form, and not one resembling the parent. The great interest of these families is the evidence afforded of the selective power of the model over the proportions of the mimetic forms of the mimic. The dominant Danaine pattern of Natal is that exhibited by *Amauris echeria* and *A. albimaculata*, and the corresponding mimetic female of *P. dardanus* is equally dominant. Further to the north, where *Amauris niavius*, subsp. *dominicanus*, predominates over, and in many areas altogether displaces, *echeria* and *albimaculata*, the corresponding *hippocoon* female of *dardanus* predominates over and finally displaces the *cenea* form.

Additions to the British Collections in 1907.

Mr. W. Holland's *Carabidae*, chiefly presented to the Department in 1901, but also increased in subsequent years, constitute by far the largest part of this section of the British beetles. Nearly all the British *Carabidae* have now been

arranged, with the kind help of Commander Walker, by Mr. Collins, in thirty drawers, so that any student of British "ground-beetles" who visits the Department will at once realize how much the University Collection of these fine insects is indebted to Mr. Holland's generosity. Out of nearly 4,400 specimens already arranged, over three-quarters have been presented by him. All possess admirable data of time and place, and the great majority—captured in the Reading and Oxford districts—have the additional interest of being representative of the neighbourhood.

One hundred and ninety-four Coleoptera and 54 Hemiptera from many British localities were presented by H. St. J. K. Donisthorpe, Esq., F.E.S. The localities include the Isle of Wight (1894), Middlesex (1892, 1906), Kent (1890, 1906), Berkshire (1906), Norfolk (1906), Surrey (1893, 1905, 1906), Dorset (1896, 1906), Hertford (1906), Hampshire (1906), N. Wales (1906), Durham (1906), Devonshire (1906), Cumberland (1903), Bedford (1906), Birmingham (1906), Staffordshire (1906), Cambridgeshire (1893), Perthshire (1900), Leicestershire (1902), Northumberland (1900), Sussex (1895). This valuable donation to the British Collection brings the number of species of British Coleoptera to 1,375 out of a total of 3,294, presented by the same generous friend of the Hope Department. A minute Hymenopteron and the following interesting addition to the bionomic series were also presented by the same kind donor:—A *Tenthredo* (Hymenoptera Phytophaga) captured with its Dipterous mimic in the New Forest (July 17, 1906), and another pair from Harlech, N. Wales (June 22, 1906); numerous fragments of insects from an owl's nest (Richmond Park, March 29, 1906) and the excrementa of birds (Cheshunt, Hertford, June 19, 1906, and Sutton Broad, Norfolk, June 8, 1906). The latter of these consisted of fragments of Phytophagous beetles of the genus *Donacia*, found upon freshwater plants.

The following specimens were presented by W. J. Lucas, Esq., B.A., F.E.S., who has rendered kind assistance to the Department for many years. A set of 8 examples of the Blattid *Ectobius lapponicus* (Surrey, 1896–8, and the New

Forest, 1898–1901); also 2 specimens of an exotic cricket now established at Kew, captured Feb., 1907; 22 insects from the following localities:—Lymington (1907), Enfield (1907), the Broads, Norfolk (1906), Wisley Pond, Surrey (1896, 1903), New Forest (1906, 1907). These include 2 examples of the largest British grasshopper *Mecostethus grossus*, 3 females and 1 male of the dragon-fly *Orthetrum cancellatum*, and a specimen of *Periplaneta americana*.

Two examples of the Chrysomelid beetle *Phaedon tumidulus*, and one of its mimic, the Histerid beetle *Saprinus virescens*, were presented to the bionomic collection by Commander J. J. Walker, R.N., Hon. M.A., F.L.S., F.E.S. Models and mimic were captured together on the leaves of *Pastinaca sativa* (May 25, 1907) at Cothill, near Abingdon. Commander Walker also presented thirteen insects from the Oxford district and other English localities (1904–7). The species include *Brachytron pratense*, 3 examples of the squirrel flea, *Trichopsylla sciurorum*, as well as 2 *Ectobius lapponicus* (New Forest, July 13, 1907).

In addition to the valuable donation to the bionomic series described on p. 747, two co-types of the Dipterous insect *Phora pubericornis*, Malloch (E. M. M., 1908, p. 12), from Murroch Glen, Bonhill, Dumbarton (Sept. 14, 1907), were presented by J. R. Malloch, Esq.

A male "stag-beetle" (*Lucanus cervus*) from Great Leigh Rectory (June) was presented by the Rev. A. Clark, M.A., Lincoln College.

Twelve examples of the Longicorn beetle *Callidium violaceum* (May 24) were presented by the Rev. W. Mansel Merry, M.A., Lincoln College.

Thirty-six English insects, chiefly from the Oxford district and captured in 1907, but a few in earlier years, were presented by Mr. W. Holland, of the Hope Department. They include many local moths in beautiful condition, a series of 20 local dragon-flies, 3 examples of the Blattid *Ectobius lapponicus*, and one of *Tettix bipunctata*.

Thirty-one insects from the New Forest and various localities in the Oxford district were presented by the captor,

Mr. A. H. Hamm, of the Hope Department. Nearly all were taken in 1907. They include 17 moths, several taken in the University Museum, and some local species; also a specimen of the "Chalk-hill Blue," *Lycaena corydon*, captured Aug. 8, 1906, at Tubney, an interesting addition to the Oxford localities of the species.

Three examples of *Locusta viridissima* from Lye Hill, near Cowley (Aug. 1907), were presented by the captor, C. H. Hamm, son of Mr. A. H. Hamm.

Two species of the Dipterous genus *Gastrophilus*, together with their puparia, were presented by Mr. J. Collins, of the Hope Department. The flies were bred (Aug. 14) from larvae found in horse-dung near Headington Wick.

Twenty-four insects from various localities in the Oxford district (June–Nov.) were presented by Mr. J. Collins. They include the following interesting species of Staphylinid beetles from moles' nests:—*Quedius vexans, Oxypoda metatarsalis, Aleochara spadicea*, and *Heterothops nigra.*

Two specimens of the "rose-beetle" *Cetonia aurata* (Aug. 14, 1907) were presented by Mr. L. Holt, and two others captured in a rose in the Linton Road Allotments (June 22, 1907) by Mr. L. Simons.

A beetle, *Cassida obsoleta*, captured in the University Museum (May 28), was presented by Mr. A. Robinson, and a "swift" moth *Hepialus lupulinus* ♀, found (June 12) in the same building, by Mr. S. Paviere.

A weevil (July 18) was presented by Mr. H. Mills.

The moth *Geometra vernaria* (July 19) was presented by Mr. H. Walters.

A specimen of *Sphinx convolvuli*, taken in the Hayfield Road at an unusual date (June 14, 1907), was purchased from Mr. Keats.

An example of *Acherontia atropos*, captured in the Bainton Road (Sept. 3, 1907), was purchased from Mr. F. W. Goddard.

The following valuable additions to the bionomic series of predaceous insects and their prey have been received in 1907 from many kind donors, mentioned in the list as observers.

The great majority are from British localities, examples from other countries being placed together at the end of the list. Many other examples as yet uncatalogued have been received from kind friends of the Department. These will be described and acknowledged in the Report of next year. Predaceous Diptera and their prey are tabulated below, the relatively few examples of predaceous insects belonging to other Orders being placed in a second list.

CAPTORS (Diptera).	PREY (chiefly Diptera).	LOCALITY, DATE, AND OBSERVER.
Spilogaster nigrinervis ♀	*Hilara litorea* ♀ .	Bonhill, Dumbarton, July 27, 1907, J. R. Malloch
2 *Spilogaster nigrinervis* ♀	Homoptera . .	Bonhill, Dumbarton, July 27 and Aug. 29, 1907, J. R. Malloch
Hemerodromia precatoria	*Psychoda phalaenoides* ♂	Bonhill, Dumbarton, July 17, 1907, J. R. Malloch
Tachypeza nubila ♂	*Psychoda phalaenoides*	Bonhill, Dumbarton, July 13, 1907, J. R. Malloch
Tachydromia infuscata? ♀	*Oscinis frit* . .	Bonhill, Dumbarton, July 27, 1907, J. R. Malloch
Hybos femoratus ♀ .	*Trichina clavipes* ♀	Bonhill, Dumbarton, Aug. 10, 1907, J. R. Malloch
Tachydromia agilis ♂	*Sympycnus annulipes* ♂	Bonhill, Dumbarton, July 27, 1907, J. R. Malloch
Hilara litorea ♂ .	*Aphis* . . .	Bonhill, Dumbarton, Aug. 3, 1907, J. R. Malloch
Caricea intermedia ♂	*Empis aestiva* ♂ .	Bonhill, Dumbarton, July 27, 1907, J. R. Malloch
" " ♀	*Argyra argentina* ♀	Bonhill, Dumbarton, Aug. 10, 1907, J. R. Malloch
Scatophaga stercoraria ♂	*Dolichopus popularis* ♂	Bonhill, Dumbarton, July 6, 1907, J. R. Malloch
Scatophaga stercoraria ♂	*Hydrotea irritans* ♀	Bonhill, Dumbarton, July 27, 1907, J. R. Malloch
Scatophaga stercoraria ♂	*Parallelomma albipes* ♂	Bonhill, Dumbarton, July 13, 1907, J. R. Malloch
Scatophaga stercoraria ♀	*Homalomyia scalaris* ♂	
Scatophaga squalida ♂	*Rhypholophus nodulosus* ♂	Bonhill, Dumbarton, July 17, 1907, J. R. Malloch
♂ and ♀ Empid *in coitû*, ♀ with prey	Dipteron . .	Near Abingdon, May 25, 1907, Commander J. J. Walker
Asilid . . .	Dipteron . .	New Forest, July 31, 1907, R. Newstead
4 Asilidae . .	Diptera . .	New Forest, July, Aug., 1907, G. Arnold
8 Asilidae . .	Diptera . .	New Forest, July, Aug., 1907, A. H. Hamm
Asilid . . .	Neuropteron . .	New Forest, July 30, 1907, A. H. Hamm
Asilid . . .	Ichneumonid .	New Forest, Aug. 5, 1907, A. H. Hamm
2 *Dysmachus trigonus*	Diptera . .	Tubney, near Oxford, July 21, 1907, A. H. Hamm
Dioctria oelandica .	Ichneumonid .	New Forest, May, 1897, F. C. Adams

CAPTORS (Diptera).	PREY (chiefly Diptera).	LOCALITY, DATE, AND OBSERVER.		
Dysmachus trigonus	*Alophora hemiptera*	,,	July 4, 1907	,,
Laphria marginata	*Cinxius* (Homoptera)	,,	July 22, 1907	,,
Empis tessellata .	*Bibio marci* ♂ .	,,	May 29, 1907	,,
2 *Empis livida* .	Diptera . .	,,	July, 1907	,,
Empis lutea . .	Dipteron . .	,,	July 6, 1907	,,
2 *Pachymeria femorata*	Diptera . .	,,	July, 1907	,,
Hybos grossipes .	Psocid . . .	,,	Sept. 3, 1907	,,
Scatophaga stercoraria	Dipteron . .	,,	Apr. 13, 1907	,,
Scatophaga merdaria	Dipteron . .	,,	July 17, 1907	,,
2 *Scatophaga lutaria*	Diptera . .	,,	July, 1907	,,
Caricea tigrina .	Dipteron . .	,,	May 30, 1907	,,
Caricea humilis .	Dipteron . .	,,	July 15, 1907	,,
Laphria gilva L. ♀	*Vespa rufa* ☿ .	Grinderwald, Hanover, Sept. 1906, Dr. Karl Jordan		
,, ,, ♀ & ♂ *in coitû*, ♀ with prey	Pentatomid bug, *Dolycoris baccarum* ♂			
4 examples of a fine Asilid fly	3 with moths, 1 with *Pyrameis cardui*	Quetta, British Baluchistan (6,000 feet), July, 1902, and June, 1903, Col. C. G. Nurse		
Small Asilid . .	Winged ant . .			
Microstylum dux ♂	*Vespa cincta* . .	Macao, China, about June, 1906, J. C. Kershaw		
,, ,, ♂	Pentatomid bug .			
5 *Microstylum dux*, 2 ♂, 3 ♀	*Cicadae* . .			
Promachus anicius	*Apis* sp. . .			
,, ,,	Locustid . .			

Predaceous insects other than Diptera are tabulated below, all the examples being British except the last.

CAPTORS.	PREY (chiefly Diptera).	LOCALITY, DATE, AND OBSERVER.
HEMIPTERA.		
Nabis limbatus .	*Tipula paludosa* ♂	Theydon Bois, Essex, Sept. 13, 1905, F. W. and H. Campion. (*Entomologist*, 1905, p. 281.)
ODONATA (Dragon-flies).		
Agrion puella . .	*Erioptera flavescens*	Epping Forest, July 7, 1907, F. W. and H. Campion. (*Entomologist*, 1907, p. 275.)
Agrion sp. . .	*Pachyrrhina histrio* ♂	Bonhill, Dumbarton, July 19, 1907, J. R. Malloch
HYMENOPTERA.		
Allantus arcuatus .	*Rhamphomyia* sp. .	Bonhill, Dumbarton, Aug. 3, 1907, J. R. Malloch
Vespa germanica .	*Pieris rapae* . .	Hugglecote, near Gloucester, Aug., 1906, G. M. Newstead
Wasp . . .	Dipteron . .	Shotover Hill, near Oxford, Sept. 8, 1907, A. H. Hamm
Mellinus arvensis .	Dipteron . .	Tubney, near Oxford, Oct. 6, 1907, W. Holland
Ampulex sp. . .	*Rhyparobia maderae*	Diego Garcia, Chagos Archipelago, 1886, Prof. G. C. Bourne

The Hope Library.

With Miss Shelford's efficient assistance the card catalogue has made great progress during the past year, and all the Orders of insects are finished except the Lepidoptera and Hymenoptera. A second card cabinet purchased in the course of the year will, it is hoped, afford sufficient space for the completed catalogue.

Donations.

The following publications and Reports were presented :—

Bombay Natural History Society : Journal, vol. xvii (1907).

Boston Society of Natural History : Proceedings, vol. xxxiii (1907).

Bristol Museum : Report for 1905–6.

British Museum, Trustees of the :—

W. F. Kirby, A Synonymic Catalogue of Orthoptera vol. ii.

Sir G. F. Hampson, Bart. : Catalogue of Lepidoptera Phalaenae, vol. vi.

E. E. Austen : Illustrations and Notes of Blood-sucking Flies.

Cambridge University : Forty-first Annual Report for 1906 of the Museum and Lecture-rooms Syndicate.

India Office, Secretary of State for India in Council :—

The Fauna of British India, including Ceylon and Burma.

W. L. Distant, Rhynchota, vol. iv (Homoptera), Part I.

Lieut.-Col. C. T. Bingham, Butterflies, vol. ii.

Indian Museum, Calcutta : Report for 1905–6.

Ireland, Department of Agriculture and Technical Instruction for : Four treatises on Marine Crustacea by the following authors :—S. W. Kemp, B.A. ; W. M. Tattersall, B.Sc. ; E. W. L. Holt ; J. Pearson, M.Sc.

Liverpool School of Tropical Medicine : Insects and other Arthropoda collected in the Congo Free State, R. Newstead, J. E. Dutton, and J. L. Todd.

New York State Museum : Fifty-seventh and fifty-eighth Annual Reports.

Owens College: Report of the Manchester Museum, 1906–7.

Ottawa Experimental Farms: Report, 1907.

Radcliffe Library: Catalogue of Books added to the Library in 1906.

Sarawak Museum: Report for 1906.

Smithsonian Institution, Washington: Memoirs on Insects and Crustacea by the following authors:—H. A. Pilsbury, Nathan Banks, H. G. Dyar, A. Weckel, C. B. Wilson, A. Busck, A. N. Caudell, Lord Walsingham, Harriet Richardson.

United States National Museum, Washington: Annual Report for 1905–6.

United States, Department of Agriculture: Bureau of Entomology, Washington: Fifty bulletins on Economic Entomology by various authors; three monthly lists of Publications issued by the Department; Report of the Inspector of Apiaries.

The following authors have presented their publications to the Library:—

W. S. Blatchley: The Orthoptera of Indiana.

Dr. Carolus Brancsik: A complete set of his valuable memoirs on insects of various Orders.

Monsieur A. Conte, of Lyons: Essai de classification des Lépidoptères, producteurs de soie.

Dr. Frederick du Cane Godman, D.C.L., F.R.S., &c.: Natural History of the Azores or Western Islands.

Dr. J. L. Hancock, of Chicago: A Monograph of the Tetriginae, from the Genera Insectorum (Wytsman).

M. Jacoby and H. Clavareau: Coleoptera Phytophaga, Fam. Chrysomelidae, Sub-family Clytrinae, from the Genera Insectorum (Wytsman).

Dr. F. Karsch, of Berlin: Thirty-three memoirs, chiefly on Orthoptera, and seventeen papers on Coleoptera.

Monsieur Ch. Oberthür, of Rennes: Observations sur la Sesia uroceriformis, var. Americana, and Études de Lépidoptérologie comparée, Fascicule II, Rennes, 1906. The latter publication contains three beautifully coloured plates, one illustrating mimicry in certain Nymphaline butterflies of

S. America, and two the yellow-marked species of *Neptis* from China and Thibet. It is a valuable contribution to subjects which are specially studied in the Hope Department.

L. Peringuey, F.L.S., F.Z.S., Curator of the South African Museum, Cape Town: Catalogue of the Coleoptera of South Africa, Parts II to VI, and thirteen memoirs on Insects; also Report of the Inspector of Vineyards for 1886, Cape of Good Hope, Cape Town.

Dr. W. A. Schulz: Hymenoptera, Fam. Trigonaloidae, from Genera Insectorum (Wytsman); Schwimmende Braconiden; and, in conjunction with E. Rousseau, Les Hyménoptères Aquatiques avec description de deux espèces nouvelles.

Dr. Y. Sjöstedt, of Stockholm: Seven papers on Insects.

Dr. W. L. Tower, Instructor in Embryology, University of Chicago: A noteworthy memoir, fully illustrated, entitled An Investigation of Evolution in Chrysomelid Beetles of the Genus Leptinotarsa.

Original papers have also been presented by the following authors:—Dr. N. Annandale, B.A., Balliol College, Superintendent of the Indian Museum, Calcutta; G. J. Arrow, F.E.S.; Professor C. Aurivillius (four memoirs); E. E. Austen, F.Z.S.; Professor T. Hudson Beare, F.R.S.E., F.E.S.; Dr. E. Bergroth, C.M.Z.S. of Tammerfors, Finland, and Seattle, Washington, U.S.A.; Lieut.-Col. C. T. Bingham, F.Z.S., F.E.S.; Professor E. L. Bouvier, of the Paris Museum (six memoirs); Dr. M. v. Brunn, of Hamburg Museum; Malcolm Burr, B.A., New College, F.G.S., F.L.S., F.E.S. (eight memoirs); Vicomte R. du Buysson (three memoirs); H. Hamilton Druce, F.Z.S., F.E.S.; Dr. E. Giglio-Tos, of the University of Cagliari, Italy (four memoirs); Dr. F. D. Godman, D.C.L., F.R.S., &c.; Dr. Achille Griffini, of the Royal Technical Institute of Genoa; C. Gordon Hewitt, B.Sc., Owens College, University of Manchester; Dr. Walther Horn, of Berlin (four memoirs); W. F. Kirby, F.L.S., F.E.S. (six memoirs); Dr. G. B. Longstaff, M.A., D.M., New College, F.R.C.P., &c., and Mrs. Longstaff; W. S. Marshall and H. H. Severin; W. S. Marshall and C. T. Vorhies; G. A. K. Marshall, F.Z.S., F.E.S. (three memoirs); F. Merrifield, F.E.S.; Dr. J. A. G. Rehn, of

Philadelphia (five memoirs); Dr. A. Schulthess-Schindler, of Zürich (six memoirs); E. H. Sellards (two memoirs); R. Shelford, M.A., F.L.S., &c. (three memoirs); Rev. T. R. R. Stebbing, M.A., Worcester College, F.R.S., F.L.S.; Dr. V. Szépligeti, of Buda Pesth; R. E. Turner, F.E.S.; Dr. W. M. Wheeler, of the American Museum, New York.

Valuable additions to the Library have been presented by the following donors:—

Vicomte R. du Buysson, Paris Museum: Sixty-one treatises on Arthropoda of various groups.

Sir John Evans, K.C.B., D.C.L., F.R.S.: The Second Report of Wellcome Research Laboratories, Khartoum.

Dr. G. B. Longstaff, M.A., D.M., New College, F.R.C.P., F.E.S.: Kirby's Catalogue of Diurnal Lepidoptera and Supplement.

The publications of the Société Entomologique de France for 1907, and of the Société Entomologique de Belgique for 1907, the publications of the Linnean Society for 1907, the Transactions of the Entomological Society of London for 1907, and the Proceedings of the Association of Economic Biologists, vol. i, Parts I, II, and III, and Book of Laws were presented by the Professor.

Hon. Walter Rothschild, Ph.D., M.P.: The parts of the Novitates Zoologicae of the Tring Zoological Museum, published in the year 1907.

Edward Saunders, F.R.S., F.L.S., F.E.S.: Drawings of Coleoptera and Diptera made by the late Professor Westwood in 1846 for the father of the donor. It is peculiarly appropriate that these beautiful drawings by the late Professor should now be added to the library of the Department over which he presided for so many years.

R. Shelford, M.A., F.L.S.: Sixteen Treatises on Arthropoda, and the Annual Register of the University of Chicago, 1906–7.

E. J. B. Sopp, F.R.Met.S., F.E.S.: A memoir on Orthoptera by H. Gadeau de Kerville.

Exchanges.

The following were received in exchange for the Hope Reports:—

American Entomological Society, Philadelphia, Transactions, vols. xxxi, xxxii (1905, 1906).

Deutsche Entomologische Zeitung for 1907.

Entomologisk Tidskrift, Stockholm, vol. xxviii (1907).

Bulletins de la Société Entomologique Suisse, Berne, vols. i–x and vol. xi, Parts I–VI, 1861–1907. This exchange was arranged in the course of last year, the Swiss Society courteously giving a complete set of their publications, hitherto entirely unrepresented in the Hope Library. In addition to the five volumes of the Hope Reports, the Professor presented separata of a number of his own papers to the library of the Swiss Society.

Purchases.

The following publications of the year 1907 were purchased for the Department:—The Ray Society volume, the volume of the Zoological Record, the numbers of the Entomologist's Monthly Magazine, the Entomologist, and the Entomologist's Record.

In addition to the above—the normal expenditure for many years—the following purchases were made:—Souvenirs Entomologiques, Series I to IX, by J. H. Fabre. The Ichneumons of Great Britain, vol. i, Ichneumoninae; vol. ii, Cryptinae; by Claude Morley. A Natural History of the British Lepidoptera, vol. v and vol. viii, by J. W. Tutt. Die Insektenfamilie der Phasmiden, Parts I and II, by Hofrath K. Brunner v. Wattenwyl and Dr. Jos. Redtenbacher.

E. B. POULTON.